OCTOBER 14, 1961

Chemical Week

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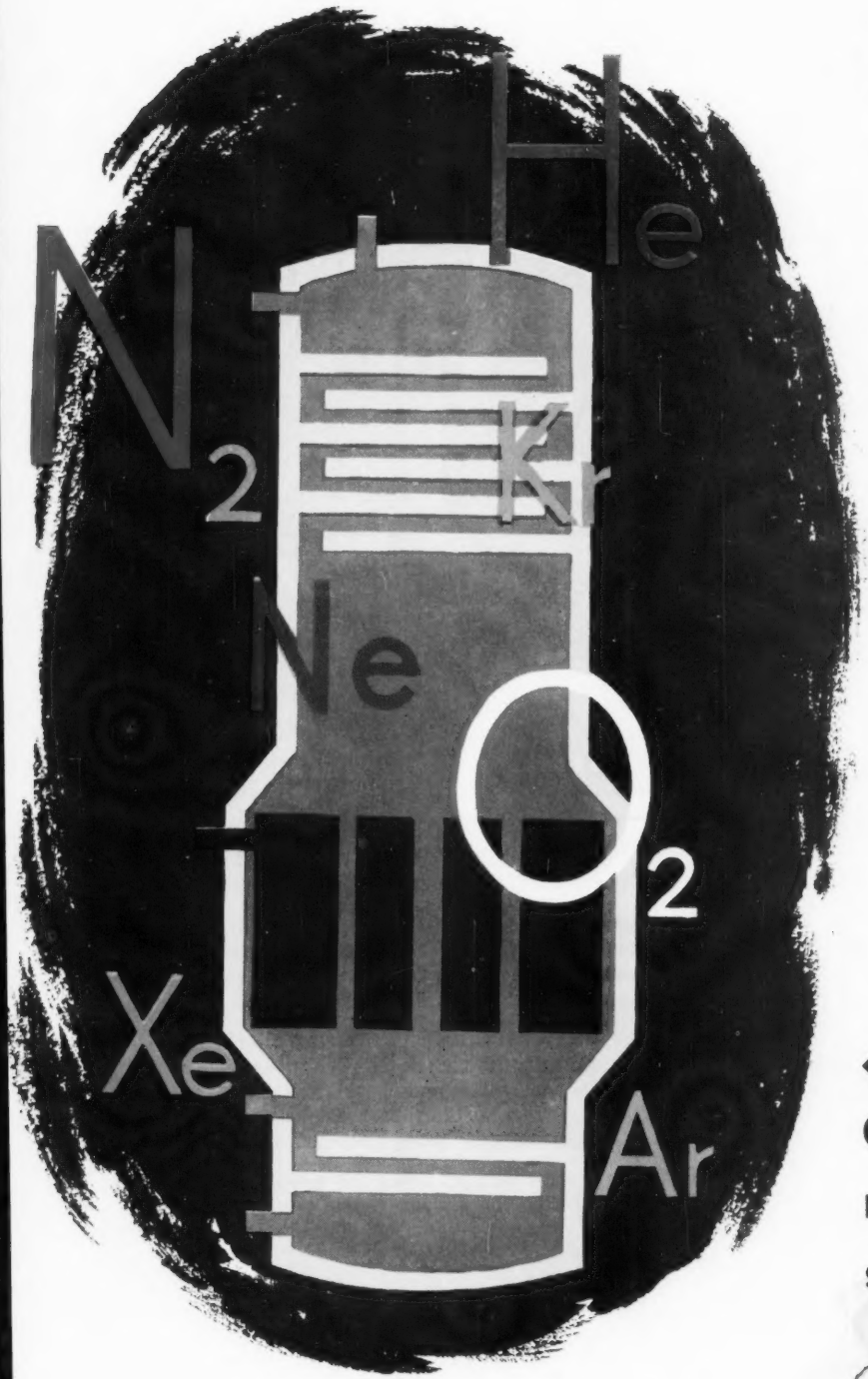

Fertilizer ferment— rash of new projects brightens industry outlook . . . . . p. 29

Portland—big things are happening in the Northwest's specialties hub . p. 35

When sirens wail— how companies would protect personnel from fallout . . . p. 38

The '62 models— they reveal shifts in Detroit's chemical buying pattern p. 115

◀ Special Report
Cryogenic gases, now $520 million, still [illegible]

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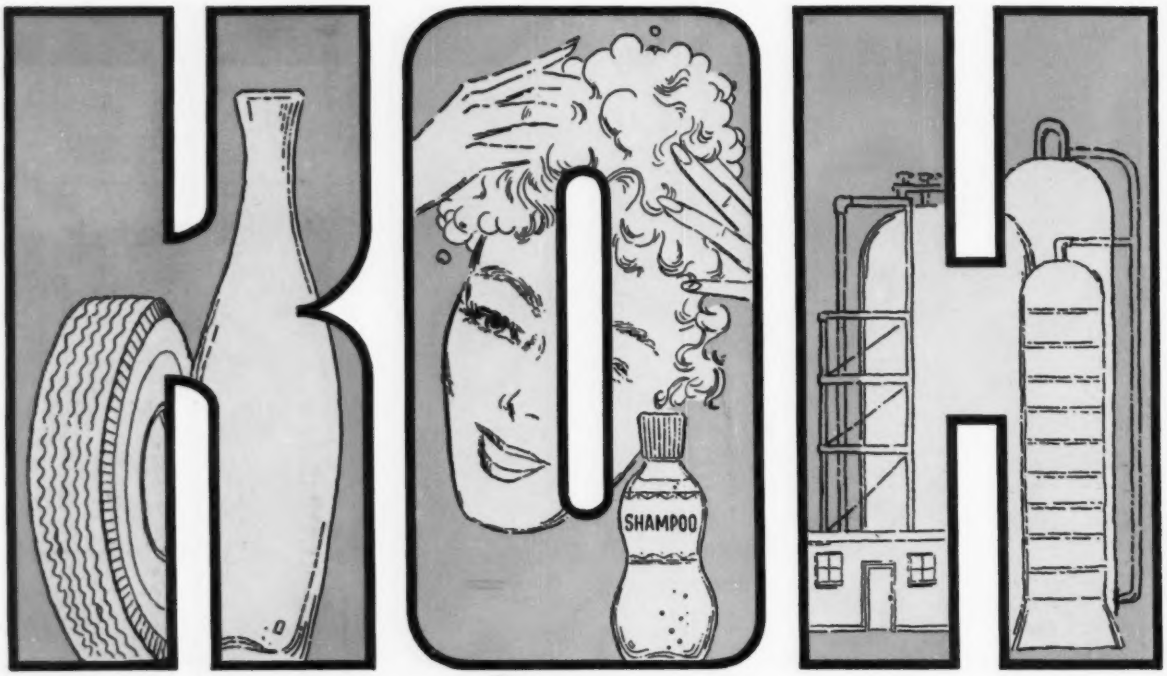

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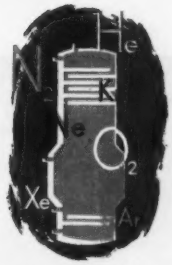

ON THE COVER: This stylized air-separation column symbolizes the cryogenic-industrial gas industry—currently a $520-million/year business, and growing fast. See p. 55.

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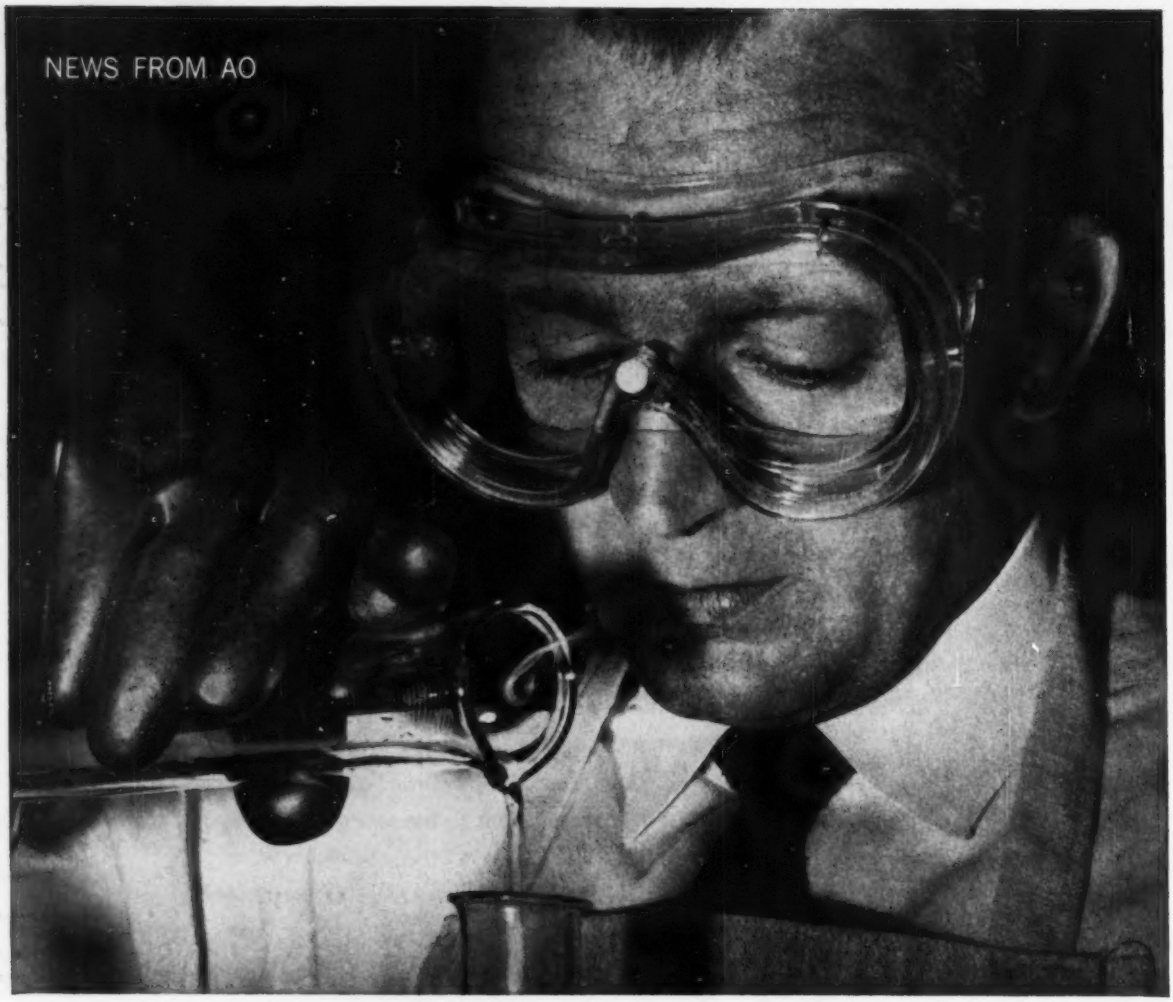

New AO Splash Goggles Have Full Ventilation . . .

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You can give your workers maximum eye protection . . . keep them cool and comfortable . . . with the AO 710 Splash Goggle. This goggle was developed in conjunction with a leading chemical company to combine adequate ventilation with protection from splashing liquids, spray or the hazards of flying particles. There are no direct vents in the frame, yet the AO 710 has proved twice as fog-free as similar conventional goggles.

Soft vinylite frame molds comfortably to facial contours. The goggles fit perfectly over all personal and safety Rx glasses, give wide-angle vision for greater safety and working efficiency. Lens is .050″ plastic, easy to clean or replace, available in clear or green.

For molten sodium and radiant heat, there is the AO 711 Splash Goggle. Similar in all respects to the AO 710, it has plastic shields to protect the forehead, nose and lower face. A hook on the nose piece permits the attachment of a drape to cover mouth, neck and chest. For details on these or the full AO line of flexible mask goggles, contact your AO Safety Products Representative, or write for folder S-1229.

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Washington's Heavy Hand

COPING WITH TODAY'S problems is often so pressing that we neglect to observe and appraise the long-term trends that are creating problems for next year—or five and 10 years hence. That's why it's important to listen to Malcolm P. McNair, Harvard Business School professor of retailing, who has taken time to look at the future. Writing in the current *Harvard Business Review,* he foresees many challenges, the foremost of which is "the trend for the federal government to exercise more influence, persuasion, and intervention in business affairs with the accompaniment of higher spending and increased taxes."

He argues the inevitability of an increased governmental role on the basis of world unrest; our deteriorated position in the international economy; the Administration's distrust of the free market and the accompanying "papa knows best" school of thought; and the inherent contradictions in the Kennedy program that in time will require control.

If we accept his premise, what does it mean for industry? Professor McNair sees six probable trends:

(1) More spending, both for defense and "welfare state" purposes; a larger governmental share in the investment function, especially in research and development; and more "mixed" enterprises—e.g., port authorities and urban redevelopment authorities.

(2) The profit squeeze will continue. Significant inflationary tendencies will likely be checked by controls; hence, don't look for any private investment boom in the early '60s.

(3) Don't look for any meaningful tax relief. Deficits are likely throughout the early '60s.

(4) Expect policies and measures to increase exports. These must grow in order to offset the drain on gold caused by our heavy overseas expenditures on defense and aid.

(5) The domestic consumer economy may not grow as rapidly as during the '50s. Defense and space spending will strengthen the hand of those who inveigh against the "frivolity" of consumer spending; and tax policy may limit the growth of discretionary spending.

(6) "Business management in the years just ahead will be hampered by an increasing degree of government control and regulation . . . more investigations in such areas as prices and advertising, more activity by the Federal Trade Commission and the Dept. of Justice, more use of publicity and persuasion as means to influence business action—all with resulting attrition in the freedom of management to determine prices, to select customers, to lay off or discharge employees, to change plant locations, to select advertising methods and appeals, and to buy or sell businesses."

If Professor McNair is right—and he makes out a persuasive case, then Secretary of Commerce Luther Hodges has his work cut out. Just last week he expressed concern over mounting criticism that he is "antibusiness." No one can seriously believe that Secretary Hodges—formerly a successful business executive—doesn't understand the businessman's concern; he simply threw in his lot, for his own reasons, with an Administration whose philosophy is, in Prof. McNair's words, "distrust of the slow democratic process and the verdicts of the marketplace and genuine conviction that society for its own good can best be managed by an intellectual elite."

Unchecked, these trends will inevitably lead to Historian Arnold Toynbee's belief: "The businessman of the future . . . will be one of the key figures in a world civil service."

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LETTERS

National Starch's Latex

To THE EDITOR: We wish to point out . . . the statement (*CW, Sept. 16, p. 54*) that National Starch and Chemical Corp.'s new fire-retardant paint latex, Resyn 1066, was developed by Dow Chemical.

National's Resyn 1066 base is its own development. It can be used in various types of fire-retardant latex paint formulations—some of which fall within the scope of a Dow patent. Others do not.

The confusion over National's relationship with Dow in this area may result from the fact that National is authorized to grant nonexclusive licenses under U.S. patent 2,912,392 owned by Dow Chemical Co. for third parties to make, use and sell intumescent coatings and coating compositions under that patent. . . .

A. G. BATTAGLIA
Resin Division
National Starch and Chemical Corp.
New York

Sewage Defoamers

To THE EDITOR: . . . [Re] "New Challenge in Water Cleanup" (*Aug. 19, p. 41*). . . . I am compelled to take issue with certain statements made by the author. . . .

It is stated (*p. 45*) . . . "the new chemical (formula is undisclosed) is reported to be 3-10 times more effective in removing foam in water treatment plants than are other defoamers. Net cost per dose is less than that of competing chemicals, although the price per pound (25-40¢) is higher."

The very largest, and several other very large, cities in the U.S. have spent a good deal of effort in the study and evaluation of defoamers. As pioneers in this field we are proud that our Foamwilt has been selected as the standard for performance and economy specified in open bids by these cities. As against the 25-40¢/-lb. you mention, Foamwilt is but 12¢/lb. in single drums, considerably less on long-term, large-scale contracts. As against the ppm. as published elsewhere, Foamwilt is used at only 0.5 ppm., making it by far the most effective and most economical defoamer on the market. . . .

ARNOLD HAVERLEE
Technical Director
Pollution Control Chemicals Division
Fine Organics, Inc.
Lodi, N.J.

CW welcomes expressions of opinion from readers. The only requirements: that they be pertinent, as brief as possible.

Address all correspondence to: H. C. E. Johnson, Chemical Week, 330 West 42nd St., New York 36, N.Y.

Transposed Columns

To THE EDITOR: Reference is made to your chart (*Aug. 5, p. 104*); it appears to be in error showing the years '54, '56 and '58 in reverse order.

CARL S. GATES
Du Pont Co.
Photo Products
Parlin, N.J.

Reader Gates is right. We changed the order of the columns of figures but failed to change the headings at the top of the columns.—ED.

Hexachlorophene Price

To THE EDITOR: Mention is made (*Aug. 19, p. 78*) that hexachlorophene sells for $1.48/lb. in drum quantities.

We wish to point out that this price is incorrect, the correct price being $1.84/lb. in drums for 1,100 lbs. or more.

R. E. VICKLUND
Manager, Sales & Development
Sindar Corp.
New York

MEETINGS

Plastics Show of Canada, Automotive Bldg., Toronto, Oct. 17-19.

American Society of Lubrication Engineers, American Society of Mechanical Engineers, lubrication conference, Morrison Hotel, Chicago, Oct. 17-19.

The Packaging Institute, 23rd annual national packaging forum, Biltmore Hotel, New York, Oct. 18-20.

Illinois Institute of Technology, 1961 national conference on industrial hydraulics, Sherman Hotel, Chicago, Oct. 19-20.

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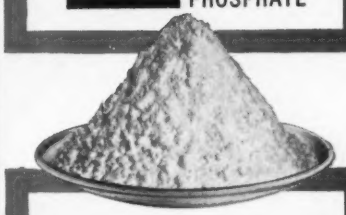
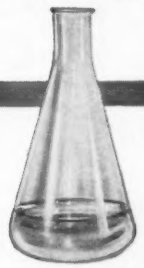


2 PARTS SOLUBLE IN 1 PART WATER



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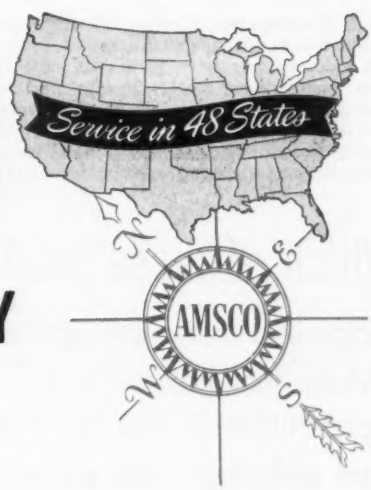

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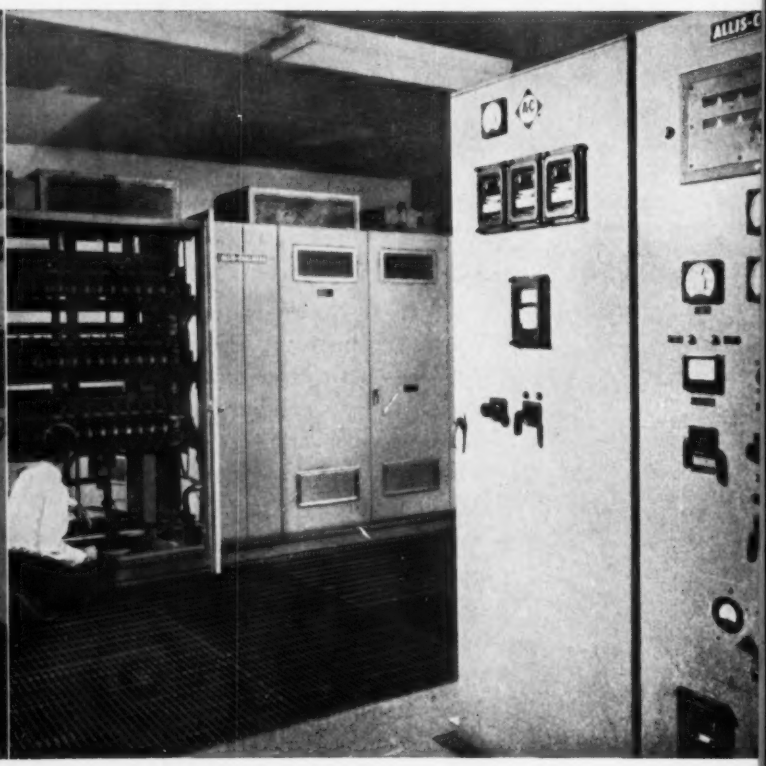

Up to 35 square feet of screening area in only 16 square feet of floor space: Stacked-deck design of this gyratory screen conserves valuable space. Cuts maintenance, downtime with all-stainless-steel construction. Abrasive or corrosive materials, dry foods and pharmaceuticals are handled with care. Gentle, quiet, vibrationless operation means minimum disintegration of fragile particles.

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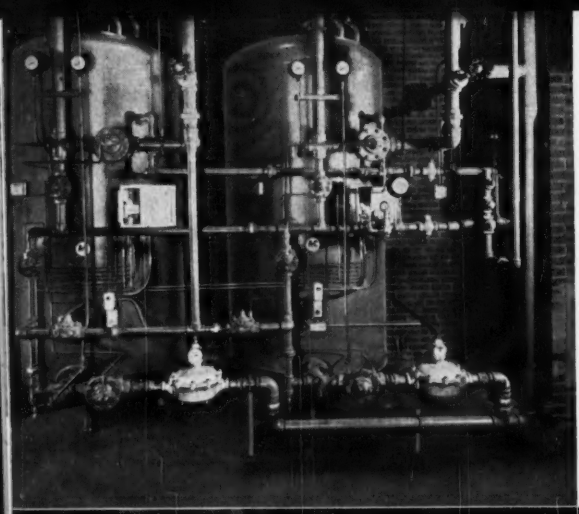
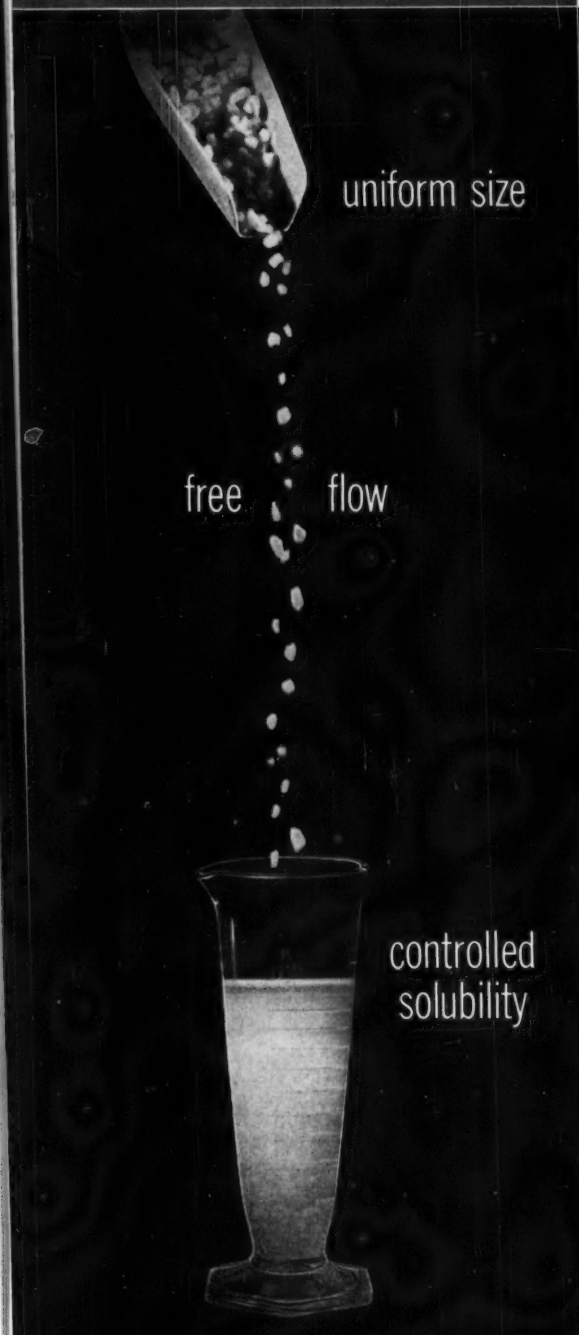
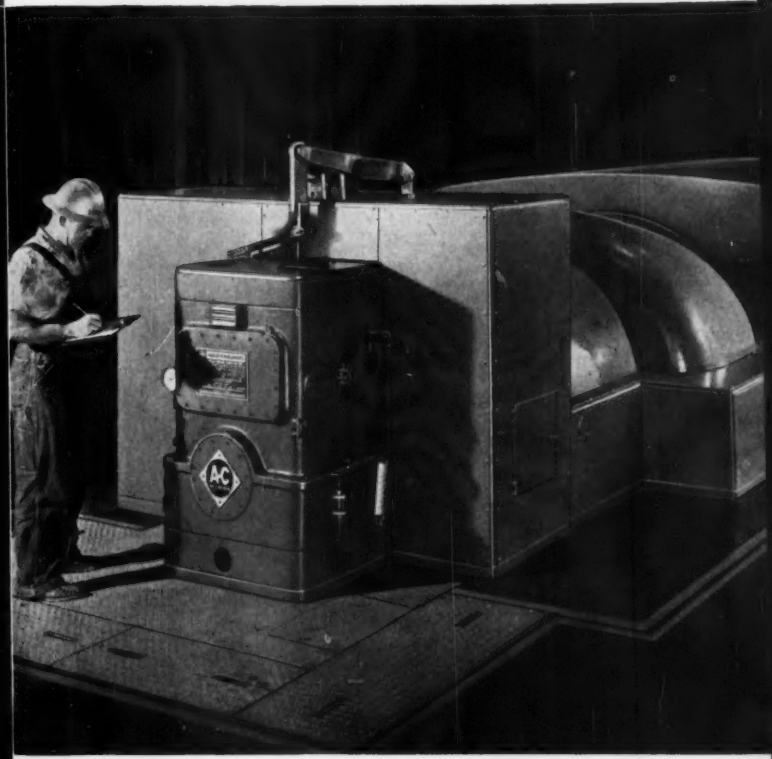


Calcium and magnesium are the "vandals" that cause scale in pipes and boilers, clog systems and mean heavy use of cleaning compounds. ZEOLITE is their natural enemy! An A-C zeolite water softener means a simple switch to sodium ions from the usual hardness present in most water supplies. Once A-C conditioned, the "softened" water finds ready use in chemical plants to end scaling problems.

Even the by-product makes an economy contribution: Versatile . . . describes these two 6250-kw condensing, automatic extraction steam turbine-generator units installed in a midwest petrochemical plant. A typical application supplying steam to a process with electric power as an economical by-product. A-C manufactures a complete line of condensing and non-condensing turbine-generator units, with or without automatic extraction, for the chemical industry. For complete information on types and ratings from 2000 kw to the largest, ask for bulletins 7654A and 9448.





Profit recovery starts with waste: The continuous mechanical compacting process recovers virtually 100% of waste fines! It compacts and screens your waste material into flakes. Then granulates them into desired product. The same process tightens your production controls when you face problems involving granular size, density, solubility and other physical properties. Integrates smoothly into your system. Requires less power, lower capital investment than less modern agglomeration methods.

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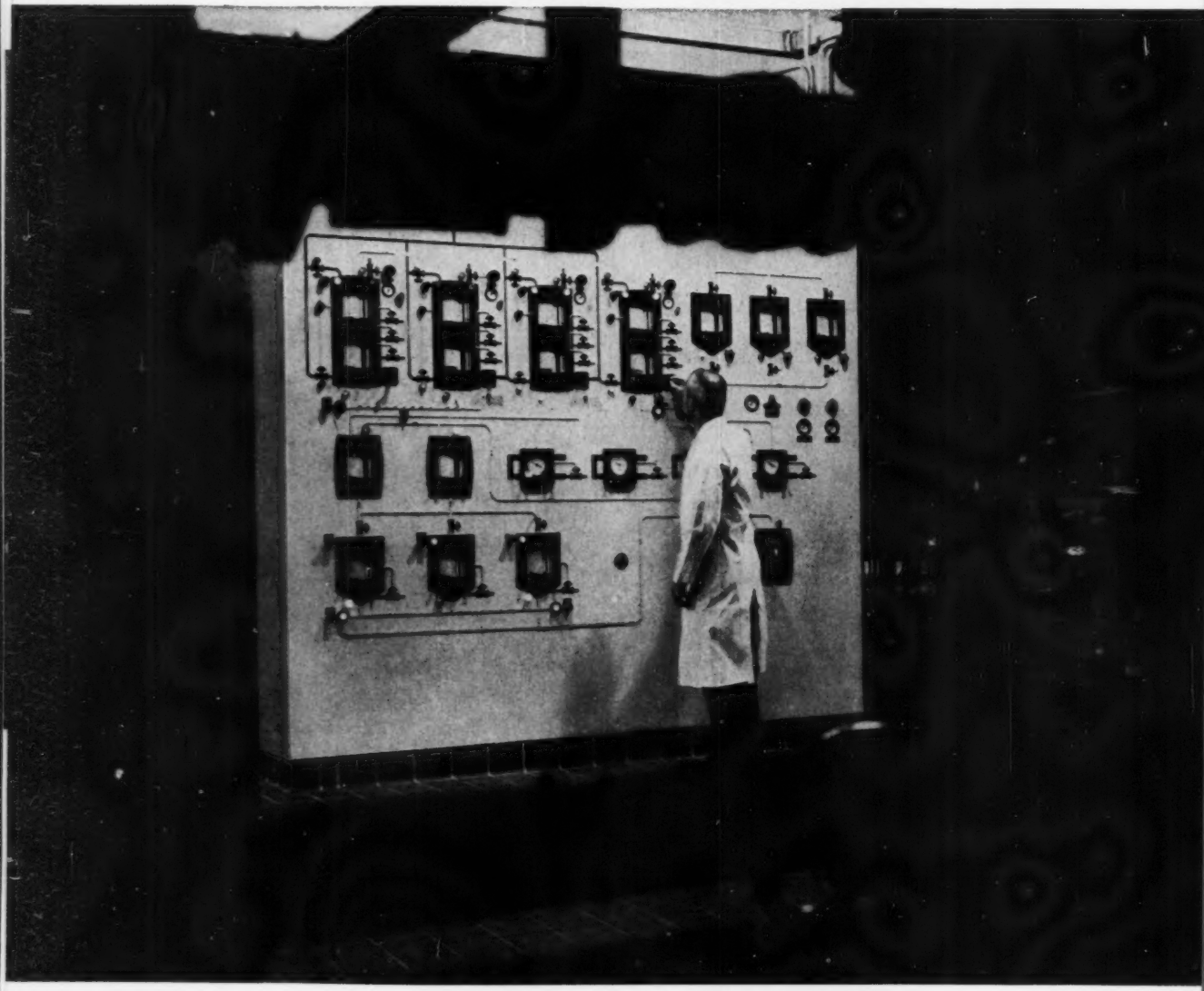
HumKo's giant vegetable oil refinery instrumented by Fischer & Porter



Hydrogenating control panel, one of seven graphic panels in the Champaign-Urbana, Illinois plant of HumKo Products, division of National Dairy Products Corporation.

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Complete integration, continuous processing, and instrumentation by F&P distinguish the HumKo edible oil refinery at Champaign, Illinois. On stream since 1958, the multi-million dollar plant processes soybean and cotton seed oil into shortenings, margarine oil and salad oil which are shipped throughout the country. *All* of the inter-connected processes—refining, bleaching, hydrogenating, blending, deodorizing and packaging—get continuous supervision from Fischer & Porter controls.

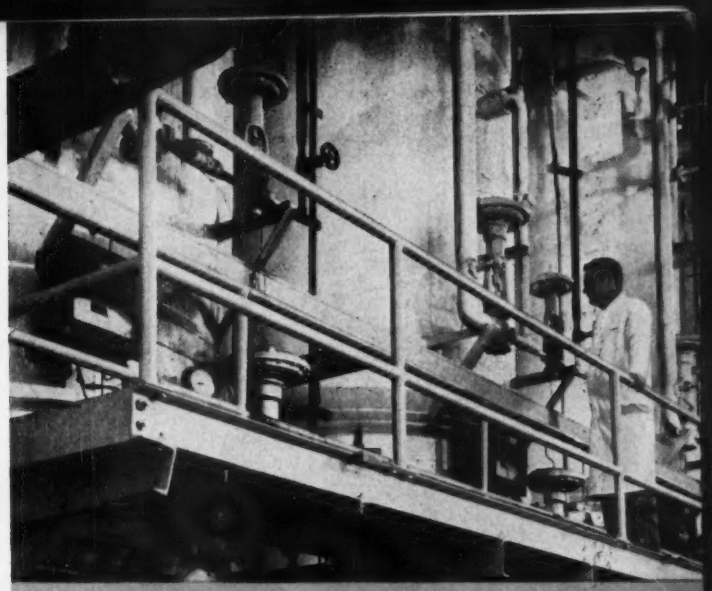
Instrumentation a Series of Control Loops

Controls for each process in the complex network are centralized at graphic panels, so that operators can easily check and change the rates of different variables. These loops employ F&P instruments for measuring and controlling variables such as temperature, pressure, flow and level. Operators report excellent performance and little maintenance.

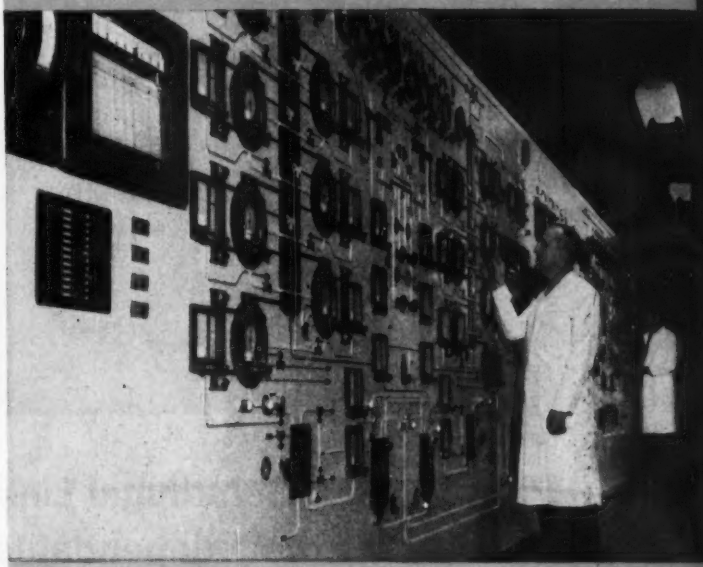
F&P means Undivided Responsibility . . .

and HumKo graphically proves the point—from engineering and installation through to start-up assistance. Learn what F&P instruments and capabilities can do for *you* in your next control system. For our over-all story in brief, write for a copy of Catalog 310. For a discussion of your specific control problem, call your nearest F&P field engineer. Fischer & Porter Company, 2201 County Line Road, Warminster, Pa. In Canada: write Fischer & Porter (Canada) Ltd., 2808 Jane Street, Toronto.

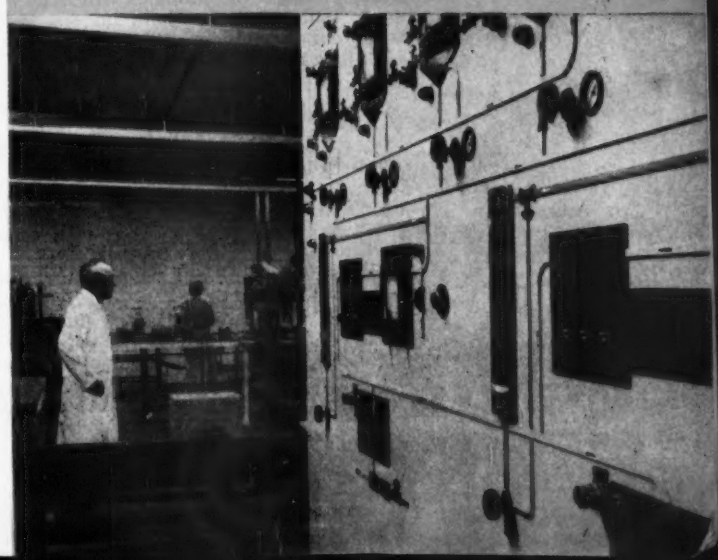
Instrumentation furnished and installed by. Fischer & Porter Company, Warminster, Pa.



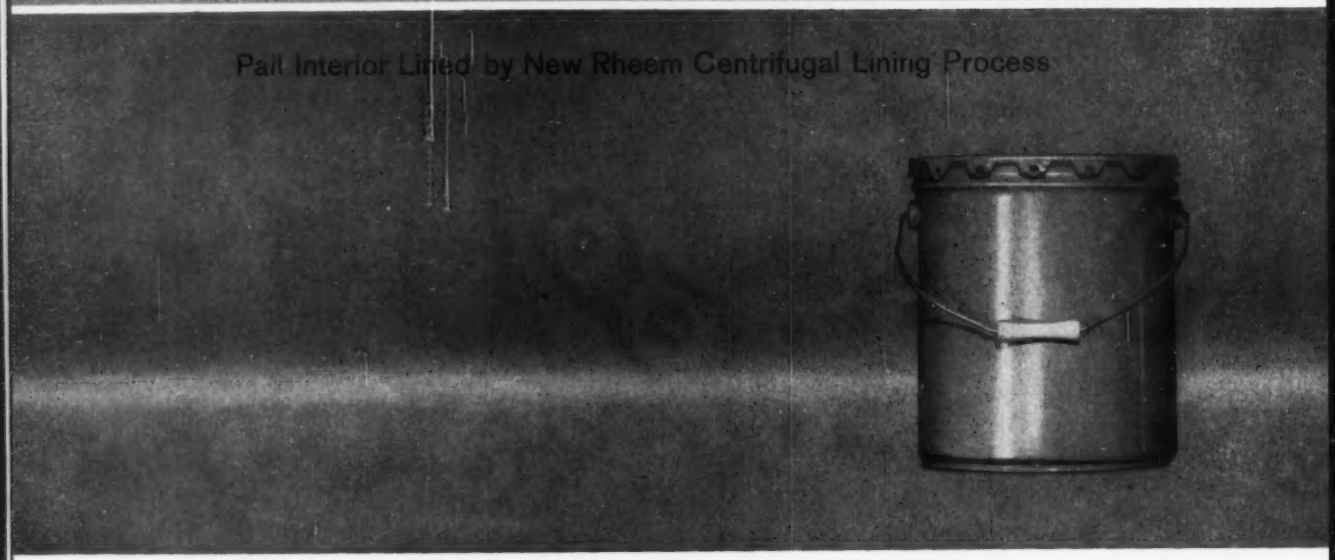
Temperature transmitters mounted near floor of platform send signals to panel for control of steam and water valves on hydrogenating converters.



Deodorizing to make the oil bland and neutral is regulated from this 60+ foot-long graphic panel.



Oil is finished by rapid chilling to a plastic consistency. Flow to the chilling machines, as well as the temperature and level of the storage vessels are regulated from this graphic panel.



Rheem Centrifugal Lining process makes pail linings completely dependable, for best product protection

Look at the blisters and pinholes in the unretouched pail lining photo at top. On impact, the blisters may break, introducing foreign particles into the product. Or, pinholes will expose the contents to bare steel. Chalk up one pail of ruined product – and one unhappy customer.

Now, look at the section of pail lined by the exclusive Rheem Centrifugal Lining process. No blisters. No pinholes or skips. No globs or thin spots, either.

Rheem lined pails assure the same product purity on delivery as at filling. Here's why:

The patented Rheem Centrifugal Lining process, first method that's not merely an adaptation of painting techniques, operates by centrifugal force instead of air pressure.

Air turbulence is eliminated, allowing a uniform coating to be applied, even in the bead. Solvent content is reduced, minimizing pinholes. The grease and grit of hose lines are avoided. Since the process is completely automatic, human error is eliminated, assuring a lining free of skips, globs and thin spots. The result is the best protection you can get for products packed in pails.

If you are now using pails lined by another process, or using packages of other basic materials, write for samples, information on linings, or a special testing program. Rheem Manufacturing Company, 1701 West Edgar Road, Linden, N. J. Plants across the country.

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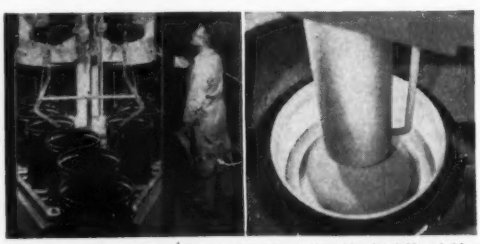

How it works: Pail shells move up to automatic Centrifugal Lining equipment (left). Positioning arms clamp pail and (right) raise it past spinning centrifugal applicator head. Angle, distance and speed never vary. Result: completely uniform linings – completely dependable protection for your product.

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Quality results from technical skills. Tennessee Products inspection and testing departments must certify compliance with your specifications before an order is shipped. This program of preacceptance of your specifications is only one example of quality control . . . giving you more dependability for a specific job.

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To get the most from your packaging ask your packaging or adhesive supplier about the outstanding properties of Airco VINOL.

Comprehensive technical information for manufacturers of paperboard, films and adhesives is available . . . call your Airco man today.

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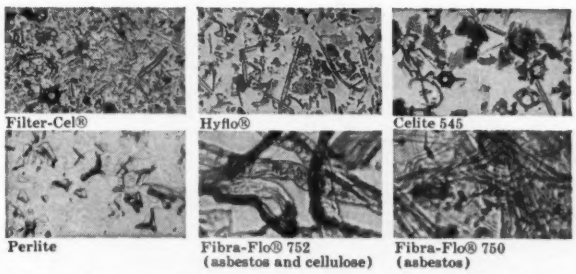

These photomicrographs show the range of characteristics available with Celite filter aids. 100μ

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Chemico process plants are operating profitably all over the map

In many areas of the world, highly-trained process engineers and technicians are a pretty scarce item. In planning process plants, the emphasis must be on trouble-free operation with minimum manpower requirements. Chemico engineers are proud of their reputation for designing efficient and economical plants which start up easily and operate smoothly. From Aruba to Sumatra, from Yokahama to Oklahoma—in 44 states and 33 foreign lands, Chemico-engineered projects continue to enhance that reputation. The estimated erected value of Chemico-designed plants has already passed the $2,000,000,000 mark; and the number of completed projects is now approaching 1,500.

Efficient process plant engineering requires a thorough familiarity with unit operations gained through a wide variety of chemical process design problems. The engineering experience accumulated by Chemico over almost half a century of service to major chemical, petroleum and petro-chemical companies all over the world, forms part of the background which Chemico engineers have developed for undertaking the most complex and extensive projects from the "grass roots" stage through start-up and production.

If you are interested in learning more about Chemico, write to "Department C".

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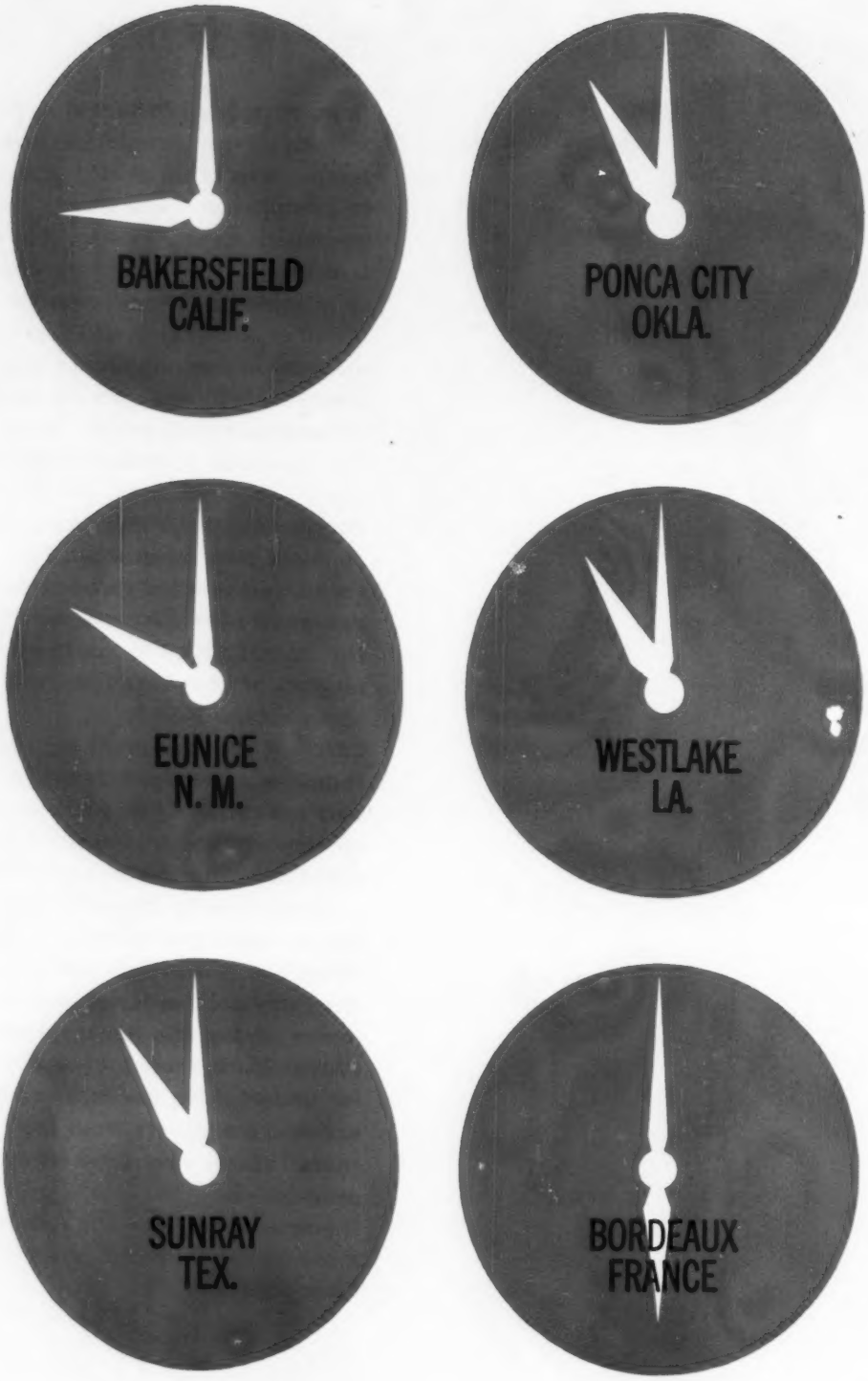

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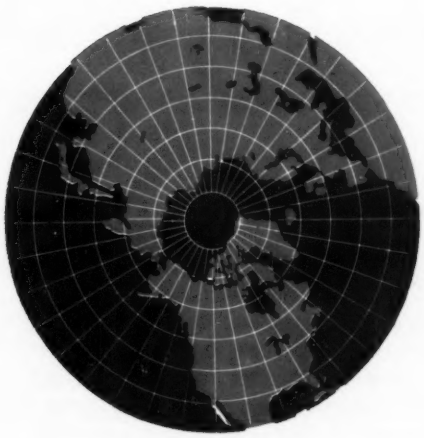

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Many formaldehyde users are asking that question. How does it differ from "inhibited" formaldehyde? Can stabilized formaldehyde also be inhibited with methanol? What about stabilizing higher concentrations? How can stabilized formaldehyde reduce cost? • You'll find the answers to these questions and a clarification of terms in Borden's new brochure on formaldehyde. Borden is a basic producer of formaldehyde and can meet your requirements for stabilized or conventional solutions from many convenient plant locations. • If you have been using a particular grade for many years, it may save you money to revaluate your formaldehyde usage. Why not call your Borden representative or write today for your free copy of Borden's new brochure: The Borden Chemical Company, Adhesives and Chemicals Division CW-101, 350 Madison Avenue, New York 17, N. Y.

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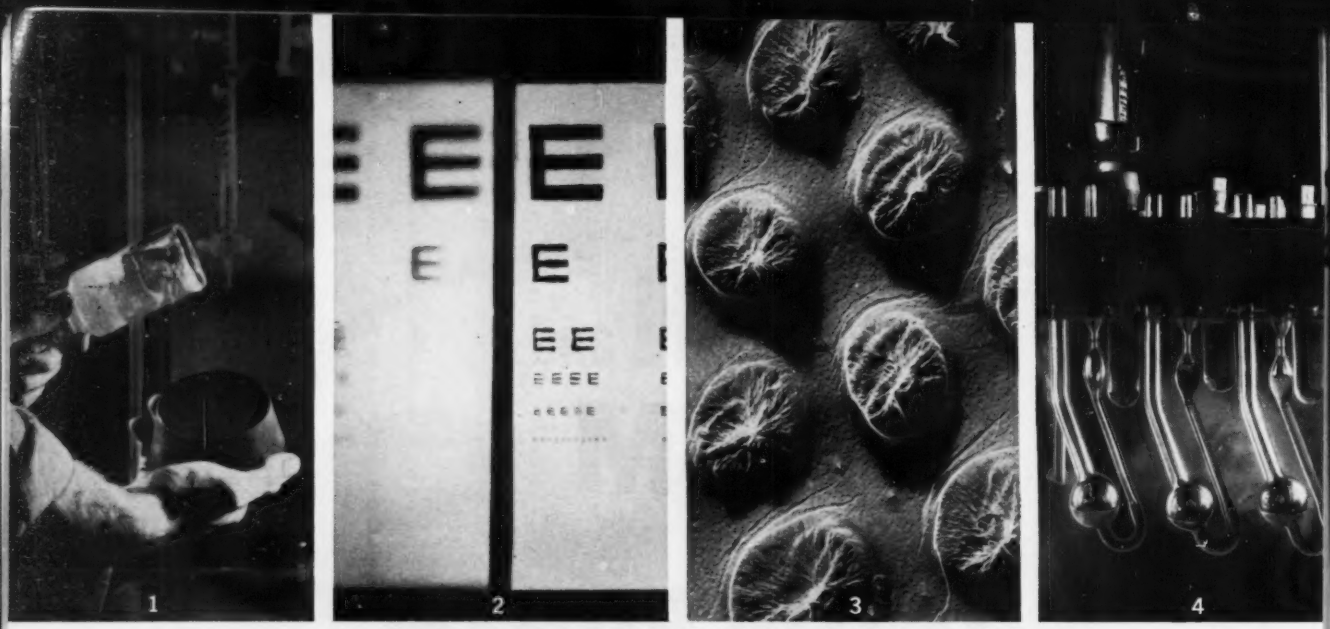

Few, if any, high boilers give you such a desirable combination of **1**) dilution ratio **2**) flowout **3**) blush resistance, and **4**) solvency as do Shell's new Pent-Oxol and Pent-Oxone solvents.

NITROCELLULOSE:

Shell's new Pent-Oxol* solvent has a 4.7 dilution ratio, excellent flowout and blush resistance, good solvency—and evaporates fully in 3375 seconds

Pent-Oxol glycol ether solvent is one of two new Shell high boilers with impressive properties for nitrocellulose. The other is Pent-Oxone,* Shell's broad-spectrum keto-ether.

These two Shell solvents can be stocked for use in nitrocellulose lacquers and thinners, then utilized in virtually every other type of coating system.

Result: quality nitrocellulose formulations, bulk-purchase savings and simpler inventory.

SHELL's new Pent-Oxol and Pent-Oxone solvents offer a unique combination of desirable properties for nitrocellulose lacquer and thinner formulations.

Viscosity, blush, dilution, flow

Eight grams of R.S. ½-Second Nitrocellulose in 100 mils Pent-Oxol solvent gives these readings:

Viscosity of 100 cps; blush resistance to 93 per cent R.H. at 80° F.; dilution ratio of 4.7 for toluene, 1.3 for high boiling aliphatic naphtha.

Similar readings for Pent-Oxone solvent are 67 cps, 91 per cent R.H., 3.1 dilution ratio for toluene, 0.9 with aliphatic high boiling naphtha.

Both Pent-Oxol and Pent-Oxone solvents are evenly evaporating, true high boilers. Total evaporation times are 3375 and 2450 seconds.

They give you the even flowout and resulting high gloss you expect.

Broad spectrum of Pent-Oxol, Pent-Oxone uses

By using Pent-Oxol and Pent-Oxone solvents in many other coating systems, you can take advantage of bulk-purchase savings and simplify inventory:

In acrylics, Pent-Oxol and Pent-Oxone solvents combine unparalleled gloss with excellent solvency.

In vinyls, Pent-Oxone solvent can lower your costs and give you a better-smelling finished lacquer.

In urethanes, Pent-Oxone solvent combines low isocyanate reactivity with good solvency, eliminates the need for premium priced specialty solvents.

Pent-Oxol and Pent-Oxone are also highly active solvents for melamines, maleics, alkyds, thermosetting acrylic epoxies, cellulose acetate butyrates of all types and a number of other basic resins.

New technical bulletins, plus samples, are available on all these applications. Write any of Shell's 9 Industrial Chemicals Division offices, or directly to Shell Chemical Company, 110 W. 51 St., New York 20, New York.

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Business Newsletter

CHEMICAL WEEK
October 14, 1961

Design work and site clearance for a naphthalene plant that Cities Service Petroleum will build at East Chicago, Ind. (*CW, Business Newsletter, Sept. 9*) is under way. Refinery changes needed in connection with the project are also well advanced.

Additional details on the projected 50-million-lbs./year plant: a hydrodealkylation process licensed by Union Oil (California) will be used to convert distillate stocks into high-purity naphthalene. Installation will be handled by Catalytic Construction (Philadelphia), and the plant will probably be in operation by mid-'62.

Cities Service says that "the designed capacity production of naphthalene will be purchased by a major chemical manufacturer." *CW* believes it is Union Carbide, but neither company will confirm or deny that such arrangements have been made. Carbide will build a major phthalic anhydride plant (*CW Business Newsletter, June 17*), and produces Sevin (1-naphthyl n-methyl-carbamate); both are outlets for naphthalene.

•

Naphthalene will be made in Puerto Rico by Commonwealth Oil Refining Co. (San Juan P.R.) (*CW, July 15, p. 24*).

Commonwealth Oil's president, Sam Casey, says construction of a 50-million-lbs./year, $6.5-million plant will begin in January adjacent to the company's refinery at Ponce. The unit will be able to make other petrochemicals, "including aromatics." Onstream target date: Jan. '63.

Universal Oil Products' Hydeal process will be utilized for the naphthalene production.

Reports out of San Juan have it that Stepan Chemical will be a major customer for the upcoming Commonwealth Oil naphthalene; that the company may take at least 35 million lbs. out of the new plant's initial annual production of 50 million lbs. and that the remainder will be placed on the open market.

Reportedly, Stepan will use the naphthalene as raw material for a projected 40-million-lbs./year phthalic anhydride plant it will build on the island. Stepan would not comment on the reports.

•

Enjay Chemical will extend its line of solvents and intermediates. New production facilities, says Vice-President R. K. Dix, will be added at Humble's Bayway, N.J., refinery. Principal product to be made in the new plant (expected to go into operation by mid-'62) will be methyl isobutyl ketone (MIBK).

•

Sun Oil may sell all or part of its share in Houdry Process Corp. to Air Products and Chemicals (Allentown, Pa.). Although the principals involved aren't ready to reveal details, negotiations reportedly under way

could lead to Sun's selling its entire 160,000 shares of HPC stock, 47% of the total 340,000 shares outstanding.

•

Harvey Aluminum asked for and received a two-week extension in the time it had for notifying Bonneville Power Administration of its plans for a 75,000-tons/year aluminum reduction plant in the Pacific Northwest (*CW Business Newsletter, Sept. 30*). New deadline: Saturday, Oct. 14.

At presstime, the company was still undecided on its plans. There's a possibility that another extension will be requested.

•

FMC Corp. will build a multimillion-dollar toluene diisocyanate plant on the site of the former Naval Ordnance facilities at South Charleston, W. Va., where the company is building a hydrogen peroxide unit (*CW Business Newsletter, June 10*).

Nearby is FMC's large chlorine-caustic plant, which will provide a substantial portion of raw materials for the TDI installation. Construction of the latter will begin early next spring; operating date: in '63.

•

A charge of embezzling company funds has been filed by U.S. Sulphur Corp. against Harry McClain, ex-president of the company. The firm's new president, Edward Kirkpatrick, Jr., says $130,000 is missing. Charges will come before a grand jury in the next couple of weeks. McClain is now free on bond.

McClain contends that the money represented funds he had loaned the company. He was voted out of United States Sulphur last March.

The company produces sulfur from its High Island plant (near Galveston, Tex.), but has not been operating since hurricane Carla knocked out its gas supply. Production may be resumed in about two weeks.

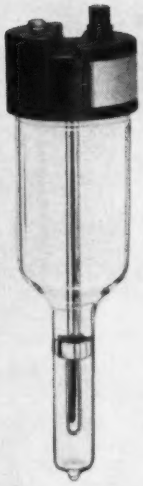
•

A new aluminum plant for Tennessee? Expectations are that Consolidated Aluminum Co. (Jackson, Tenn.) will put up a $28-million plant near New Johnsonvile, on a 235-acre tract of ex-TVA land. (Consolidated was the only bidder, paid $64,500 for the property.)

•

Common market item: Cities Service has acquired a "substantial" interest in Ammoniacque Synthetique et Derives (ASED), a principal subsidiary of Evence Coppee & Cie., of Brussels. ASED makes and markets nitrogen fertilizers, coke and chemicals. Other cooperative enterprises between Cities Service and Evence Coppee in the Common Market area are under consideration.

Pittsburgh Plate Glass International is joint owner of a new chemical company, Chemica Sarda, S.p.A. (Sardinia). The other partner is Rumianca, S.p.A. (Turin). The new company will make glycerin, trichlorethylene, perchlorethylene, and ethylene dichloride via Pittsburgh processes developed in the U.S.



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Beckman, world leader in pH instrumentation, introduces the all-new Model J pH System: compact transistorized analyzer, short, rugged electrodes, and accessory mounting assemblies. Here's continuous analysis equipment which provides reliability, flexibility, and convenience never before possible in industrial applications.

Check these Model J features, then see your Beckman Sales Engineer or Recorder Company Salesman for complete details, or write for Data File 17-41-06.

READOUT FLEXIBILITY. Available with both ma and mv output for use with any potentiometric or current recorders and controllers–or, with mv output only–recorder scale may be expanded to any 2 pH span full-scale. High or low alarm feature may be added.

SOLID-STATE ELECTRONICS. Assures reliability and saves long-term maintenance costs.

QUICK-DISCONNECT ELECTRODES. Short, rugged glass and reference electrodes feature capscrew for quick connect-disconnect of spade lug connectors. Speeds installation and replacement of electrodes.

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SIMPLIFIED MAINTENANCE. Plug-in components and circuits, rail-mounted analyzer chassis assure ease of maintenance, reduce downtime.

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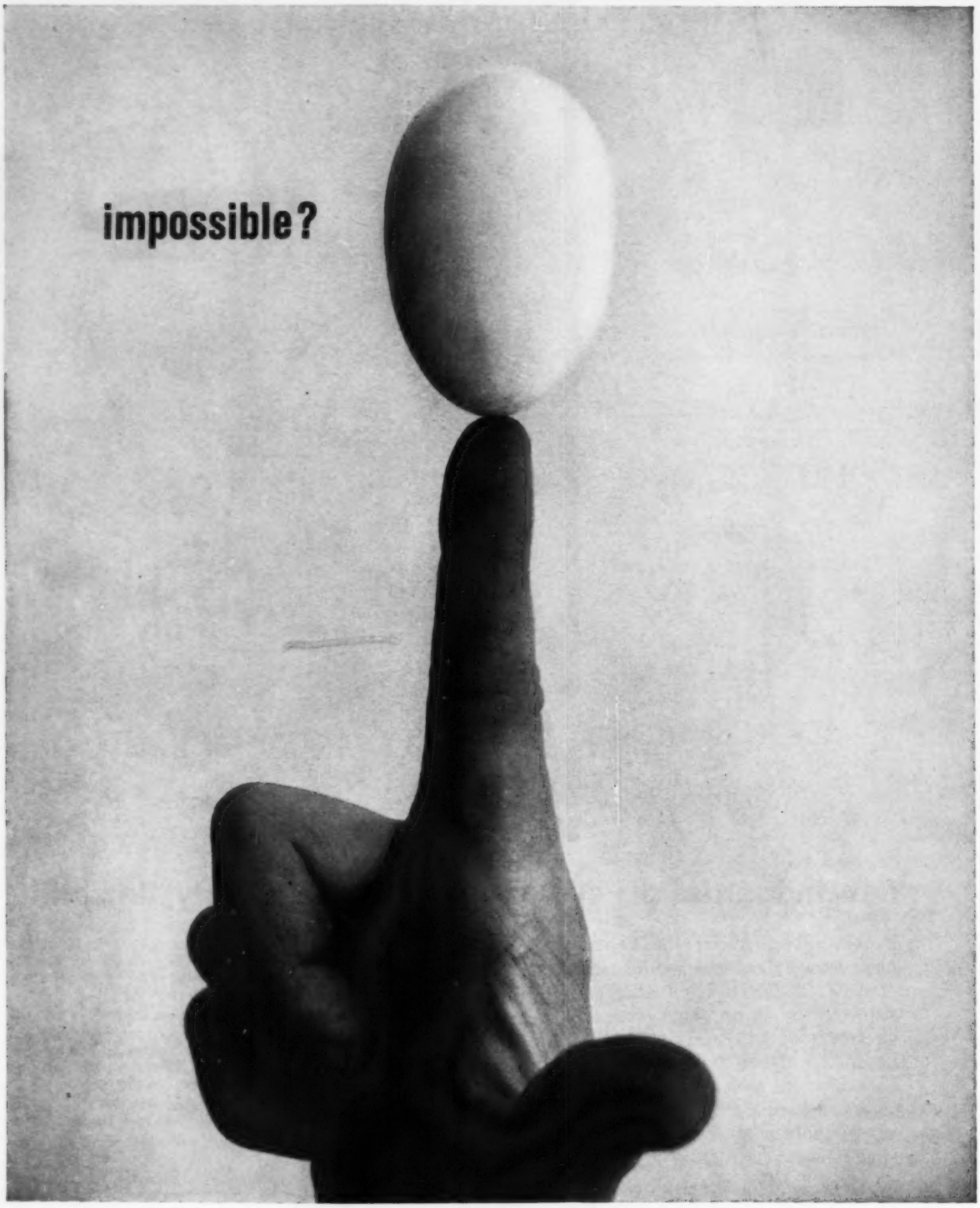

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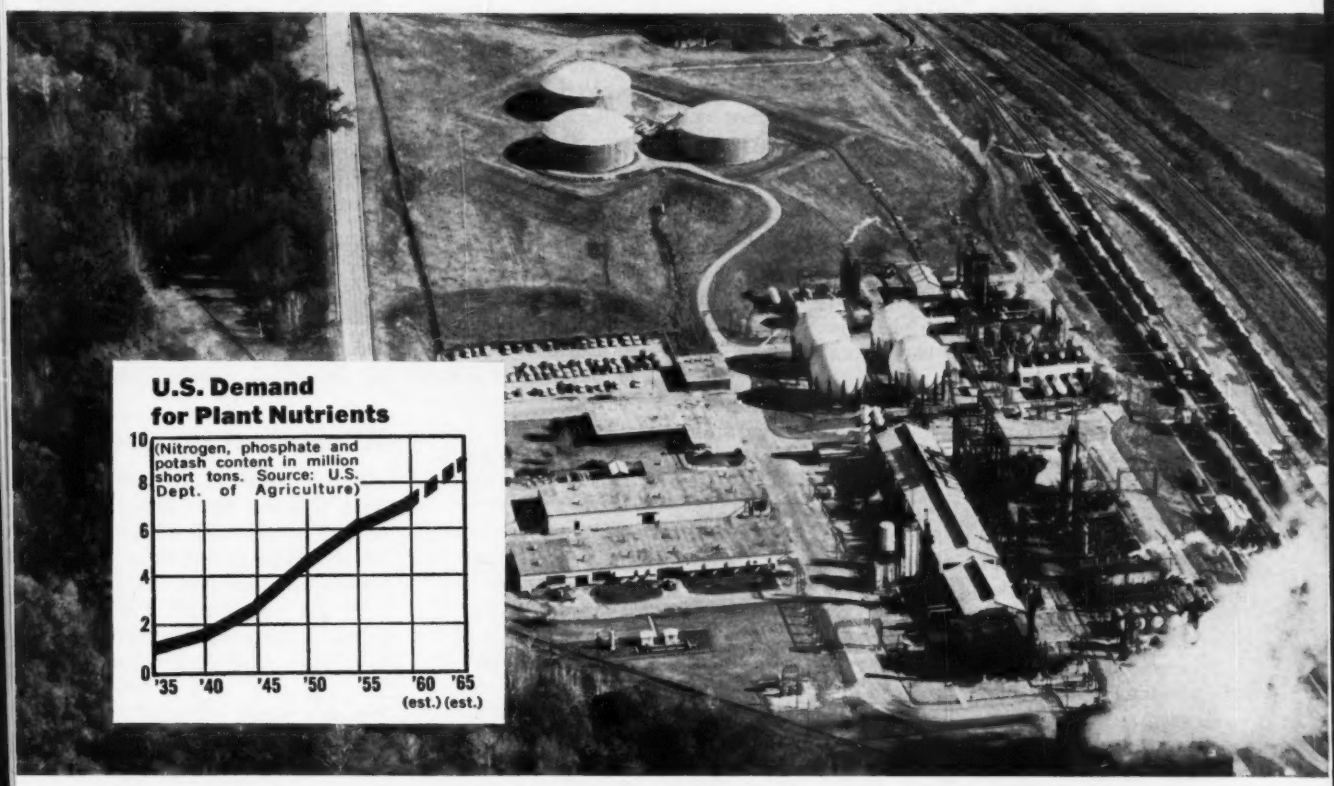


Swarm of fertilizer plants due onstream soon—like this one at Vicksburg—will keep capacity ahead of rising demand.

Building More in a Buyers' Market

With a flood tide of new plants due onstream this winter, and numerous other projects to be completed during the rest of '62, chemical fertilizer producers are concerned about the possibility of oversupply and underpricing at the peak of the fertilizer application season next spring.

No one doubts that the long-term uptrend in fertilizer consumption — with a '35-'60 average annual growth rate of 7.2%—will continue for years to come (*chart, above*). Right now, industry men are guessing that in the current fertilizer year ending next June 30, use of primary plant nutrients will advance another 5%.

But there was surplus capacity last year in all three basic fertilizer materials—nitrogen, phosphates, and potash—and the rash of new construction and modernization projects now under way practically guarantees that U.S. and Canadian farmers will enjoy the comforts of a buyers' market for the next three to five years.

Double-Barreled Products: One way in which basic fertilizer producers are trying to keep a step ahead of the competition: adding to their product lines high-analysis materials containing two, rather than just one, of the primary plant nutrients.

Thus Southwest Potash Corp. — which recently expanded its capacity for high-grade muriate of potash at Carlsbad, N.M., from 1,700 to 2,300 tons/day—is now completing construction of a $30-million plant at Vicksburg, Miss., to produce "large tonnages" of chlorine-free potassium nitrate (*picture, above*). Startup is scheduled for early next spring.

Similarly, Cyanamid of Canada—a pioneer in nitrogen fertilizer materials—is adding a unit to its Welland, Ont., plant to produce diammonium phosphate (*CW Business Newsletter, Aug. 12*). International Minerals is going into that same line in Florida, will start up in December.

Tennessee Corp.'s U.S. Phosphoric Products Division is including a Di-Mon ammonia-phosphate unit in its $9-million expansion program under way at Tampa, Fla. And Spencer Chemical is putting up a plant at its Jayhawk Works (Pittsburg, Kan.) to produce up to 50,000 tons/year of a 30-10-0 nitrogen-phosphate fertilizer.

All these double-barreled fertilizers represent chemical upgrading that's hoped to result in higher earnings for the producer as well as economies and higher efficiency for the ultimate users.

No End of Nitrogen: Typifying the big buildup in nitrogen fertilizer ma-

terials was last week's decision by a group of Midwest farm cooperative groups to put up a $20-million ammonia and derivatives plant in southern Illinois or Indiana (*CW Business Newsletter, Oct. 7*).

At least five plants with anhydrous ammonia capacity ranging from 240 to 300 tons/day are already in operation between Hammond, Ind., and Crystal City, Mo.; and three new plants are projected for sites in southeastern Iowa, just across the Mississippi River from Illinois. In addition, Allied Chemical's Nitrogen Division (with plants in Ohio and Nebraska) and Spencer Chemical (with plants in Kentucky and Kansas) have been shipping into Illinois.

Industry people in that area see some hope in the fact that corn farmers—who have accounted for possibly 80% of all nitrogen fertilizer consumption in Midwestern states — aren't using half as much nitrogen as they probably should. One estimate is that corn fields have been getting an average of only 15-20 lbs./acre of nitrogen-content, compared with recommended usage levels of up to 60-80 lbs./acre. But usage tends to increase very slowly, so that prospects are strong for a sizable pile-up of nitrogen production in the corn belt for the next few years.

Starting Up Soon: Two major nitrogen fertilizer projects that will be in production before the peak of the selling season next spring are those of Escambia Chemical at Pace, Fla., and California Chemical at Fort Madison, Ia. Escambia will begin producing urea solutions in its 20,000-tons/year plant; Cal Chem—a subsidiary of Standard Oil of California—is completing a $22-million complex with major units for ammonia (300 tons/day), nitric acid, prilled ammonium nitrate, and pelleted formulations.

Another big nitrogen expansion that will be felt in the coming spring season is being wrapped up by Southern Nitrogen at Savannah, Ga.

Phosphate Potash: More than $100 million is going into Florida phosphate expansion projects, most of which will be completed before the big shipping season next spring. American Agricultural Chemicals put $7.7 million into new phosphate and phosphoric acid facilities. Virginia-Carolina Chemical has expanded its superphosphate and diammonium phosphate units, and is completing an expansion of its calcining plant.

International Minerals and American Cyanamid also have recently put new phosphate production units on line. But the biggest current phosphate projects—both in the $30-million class—probably won't be in full operation until later next year: Armour Agricultural Chemicals at Fort Meade, and Swift & Co. at Agricola.

Potash Co. of America, Duval Sulfur and Potash, and Southwest Potash have stepped up production capacity in New Mexico since last spring. Of the two largest potash projects under way, International Minerals now hopes to have its Canadian plant in operation by late spring, and Texas Gulf Sulphur expects to have its Utah plant onstream by the end of '62. Each of these plants will have muriate of potash capacity of more than 1 million tons/year.

Final Commerce Dept. figures for the fertilizer year ended last June 30 show that nitrogen consumption continued its strong growth curve (*CW Nitrogen Report, Aug. 26, p. 33*), with anhydrous ammonia production up 6.1%, to 5,008,700 tons. Bad weather last spring cut use of other nutrients, however. Phosphate output dipped 1.1%, to 2,647,500 tons (P_2O_5 content); and potash deliveries dropped 16.4%, to 1,955,400 tons (K_2O basis).

Fertica Ready to Go

Central America's long-delayed fertilizer project is at last ready to get under way.

The articles of incorporation of the El Salvador affiliate of Fertica de Panama were signed in San Salvador on Sept. 30 by representatives of the project's participants: International Development and Investment Corp. (Cincinnati), Standard Oil (New Jersey), Phoenix Reinrohr Corp. (West Germany, and investors from El Salvador, Panama and Costa Rica.

Ground will be broken in about three months for a $5-million plant at Acajutla, El Salvador, to produce complex fertilizers, ammonium phosphate, and ammonium sulfate. Construction will take about 18 months.

The group will build a separate but interdependent plant at Puntarenas, Costa Rica, to produce ammonium nitrate as well as complex fertilizers. That one will cost $8 million.

Syria's Mamoun Kuzbari: Is new premier sitting on a political powderkeg?

What Next for Arabs?

Syria's secession from the United Arab Republic again delays the day when Arab economic integration and petrochemical coordination can become much more than talk.

By this week the political situation seemed to be stabilizing, but the outlook for tranquility is far from bright. The biggest question is how U.A.R. President Nasser will react. Syria's defection hurt Nasser's prestige. The danger is that he may try to regain it through reckless foreign adventures, against Israel, or Jordan, or even in tropical Africa.

Although Nasser seems to have firm control within Egypt, there are fears that his Syrian failure could stir up internal agitation.

His behavior so far gives grounds for some optimism. After his first vitriolic reaction, Nasser took a statesmanlike approach, renounced his intention of winning Syria back by force or intrigue, said he wouldn't bar its entry into the United Nations or Arab League. But Nasser is a shrewd dealer in international poker, and his hand may not be played out.

What happens in Syria is another source of worry. Washington welcomes Premier Mamoun Kuzbari as a respected conservative, but not much is known about his Cabinet, or about who really controls the government.

Syria has always been a hotbed of Arab agitation and a bone of contention between rival Arab forces. Although not so important in itself, Syria could become the center of turmoil throughout the Middle East.

TVA Tots Up Power

Most of the large chemical process plants in the Tennessee Valley area have maintained annual average operating rates at high levels, despite last winter's recession, according to electric power consumption figures compiled by Tennessee Valley Authority last week.

Total direct sales of TVA power to large industrial plants during the fiscal year ended June 30 dipped 2.8%, to 10,077.4 million kilowatt-hours (kwh.) But nearly all of the drop was in sales to Air Reduction, Diamond Alkali, Reynolds Metals, and Union Carbide's National Carbon division. Smaller power use cutbacks were made by Tennessee Products & Chemical, Alcoa, Tennessee Corp., and National Distillers and Chemical.

Largest increases in energy consumption were recorded by Monsanto Chemical, Hooker Chemical, and Union Carbide Metals. Another major increase was attributed to a new customer—American Potash & Chemical, at Hamilton, Miss. Others who bought more TVA power than during the 1959-60 fiscal year: B. F. Goodrich Chemical, Bowaters Southern Paper, Cumberland Chemical, General Aniline, Pennsalt Chemicals, Pittsburgh Metallurgical, and Stauffer.

Average rate charged by TVA: 4.32 mills/kwh. Rates ranged from the 3.83-mill rate paid for 836.5 million kwh. at Airco's carbide plant to the 6.16-mill rate for 218.4 million kwh. at Reynolds' alloys plant.

Agreeing at Last

Prospects for a relatively speedy and harmonious ending of the long-running Du Pont-General Motors antitrust case improved last week when the Justice Dept.'s Antitrust Division filed a proposal for final judgment that appeared to be close to what Du Pont had recommended.

Last month, Du Pont asked Federal Judge Walter J. La Buy at Chicago for a final order that would give the company pretty much of a free hand in disposing of its 63 million shares of GM stock within the 10-year limit set by the U.S. Supreme Court (*CW, Sept. 16, p. 29*). Next step: a pretrial conference to determine what issues, if any, need to be debated in court.

Some Likely Fourth-Quarter Contracts

All figures in millions of dollars

Firm	Kind of Plant	Location	Cost
Allied Chemical, Socony Mobil, Chinese Petroleum Corp.	Urea, ammonia from natural gas	Northern Taiwan	$ 22.5
American Potash & Chemical	Titanium dioxide	Mojave, Calif.	15.0
Cities Service	Naphthalene	East Chicago, Ind.	2.0
National Lead, Companhia Brasileira de Productos Quimicas Copebras	Titanium dioxide	Cubatao, Brazil	9.0
Royal Dutch/Shell	Synthetic organic acids	Rotterdam, Holland	5.6
Shell Oil	Refinery	Smyrna, Del.	80.0
Summit Industrial Corp. of Panama, Phillips Petroleum Corp.	Refinery	Thailand	25.0
The Houston Corp.	Liquid hydrocarbon extraction	Brooker, Fla.	6.3
Union Carbide	Vanadium ore reduction	Perth, Australia	1.5

Building Faster After Lull

New construction projects are coming up for contractors' bidding at an increasing pace this fall, following a pronounced third-quarter lull. It was a period in which chemical process industries' management took stock of economic and international factors, then decided to go ahead on capital spending at a higher rate than in any year since the '57 peak.

The third quarter also saw a drop in number of new CPI construction contracts awarded, compared with the first and second periods of this year (*CW, July 15, p. 31*). An unusually dull July—in which fewer contracts were let than in any other month this year or last—depressed third-quarter major-contract volume to only $217 million. The corresponding figure for the first six months of '61 was $854 million, based on a compilation of $1-million-or-more contracts reported in McGraw-Hill's *Construction Daily*.

After July, business rapidly perked up. Nearly twice the July number of chemical plant contracts were recorded in August, and September's total was close to the August level.

Foreign projects again provided a substantial portion of new CPI plant construction. Out of 41 contracts let in the third quarter, 16 were for jobs outside the U.S. On a dollar-value basis, the proportion of foreign business looms higher because most of the overseas jobs are relatively large. For example, Thai Oil Refinery (Bangkok, Thailand) and a group of firms headed by Shell Oil are building a refinery near Sriricha, Thailand, with construction costs estimated at $35 million. And Chemical Construction Corp. recently got a $20-million contract for an ammonia-urea-nitric acid complex in Maharashtra, India.

Contractors are optimistic — but with reservations. Charles Hauck, vice-president of Blaw Knox Co. (Pittsburgh), remarks: "Our optimism for '62 has been somewhat dampened . . . by developments in Washington and Berlin . . . the failure of Congress to pass the accelerated depreciation bill."

Fluor Corp.'s sales for the nine months ended July 31 rose 55.9% to $91 million; and are expected to go to $130 million this year, $150 million in '62. And CPI capital spending in this fourth quarter is expected to rise 11.5%, to $1.74 billion (*CW Business Newsletter, Sept. 16*).

Wall Street Trio

Blocs of common stock in three CPI companies — International Flavors & Fragrances, Cerro Corp. and Air Reduction—were moving in Wall Street transactions last week.

IF&F is going public, as planned when the company was formed by merger nearly three years ago (*CW, March 14, '59, p. 79*). Although IF&F will not retain any of the proceeds of this initial offering, it's expected that establishing a public market for IF&F stock will pave the way for future financing moves to support the company's worldwide growth program and its increasing emphasis on synthetic materials.

IF&F's prospectus covers three parcels of common stock: (a) 540,568 newly issued shares, to be sold directly to certain stockholders of a Dutch company, Beleg. P&S, that now owns 39.5% of IF&F's outstanding shares; (b) 409,432 newly issued shares, of which 50,000 shares will be offered first to IF&F employees, and the rest will be offered to the public; (c) 105,000 shares now owned by two principal stockholders, A. L. van Ameringen and Charles P. Walker, Jr., to be offered to the public.

No price had been set as of last week, but book value of IF&F stock as of June 30—based on shareholders' equity of $20.04 million and 2,421,310 shares outstanding — was about $8.28/share. With its proceeds, plus a relatively small additional sum from its treasury, IF&F will buy up and retire the 957,046 IF&F shares held by Beleg. P&S.

Cerro Corp. (formerly Cerro de Pasco) hoped to realize nearly $10.8 million on sale of 350,000 newly issued shares at $32.625/share. Proceeds, along with up to $15.5 million available under long-term loan agreements made last month, will go mostly into construction and modernization of U.S. plants for cement and metal products, and for copper and zinc mines and plants in Peru and Chile. Cerro and National Distillers have not yet decided whether to build a proposed $50-million aluminum reduction plant at Wauna, Ore. (*CW, Aug. 26, p. 22*).

A secondary offering involved distribution of 109,900 shares of Air Reduction stock held by an unidentified institution. Market value: $7.6 million.

GAF's John I. Snyder, Jr.

DRAWING BY RICHARD P. KLUGA

Company Builder with New Work

John I. Snyder, Jr., a man with a reputation for revitalizing companies, this week settled down to the job of building up the earnings of General Aniline and Film Corp. GAF earned $7.2 million on $159.8 million sales in '60. Snyder's aim is to double the earnings. In the two weeks since he took over as chairman and chief executive officer Snyder has toured the firm's major plants and returned to his New York office to start making GAF run "exactly like any other free enterprise."

His assertion refers, of course to the long battle over ownership of the company between the Justice Dept. and Swiss holding company Interhandel.

The government, which has owned 98% of GAF stock since seizing it under the alien property act in '42, has been enjoined from selling its interests on the open market. This has barred stock exchange as a method of acquisition.

Snyder feels that the Swiss do not have a good case, but admits it will probably be six more years before the suit can be settled.

Snyder will be dividing his time between GAF and U.S. Industries, Inc., of which he is president and chairman of the board. He took over as president of the latter in '48 after leaving the investment banking company, Kuhn, Loeb & Co. The company then was known as Pressed Steel Car Co. A maker of freight cars, it was being hurt in the decline of the railroad industry. Snyder led the company back to prosperity by diversifying into the manufacture of aircraft parts, teaching machines and hydraulic presses.

He wants to change GAF's name at the next board meeting. His choice: "Ansco Corp." The company's Ansco division in Binghamton, N.Y., is its oldest and best known.

Snyder succeeds Thomas Morgan as chairman, and President Philip M. Dinkins as chief executive officer. Morgan remains on the board; Dinkins will continue as president. Although he has been active in the Democratic party, Snyder insists his appointment had nothing to do with politics.

His two business interests could possibly be merged: Snyder says U.S. Industries would be interested in bidding for the $140-million GAF, if and when the Interhandel suit is settled.

national roundup

Companies

Rexall Drug & Chemical (Los Angeles) has acquired White Metal Mfg. Co. (New York)—a leading producer of collapsable metal tubes, slugs and aluminum cans—by an exchange of stock. Rexall says the new company will complement its container and packaging division.

Spencer Kellogg Division (Buffalo, N. Y.) of Textron, Inc., is selling its soybean-crushing plant at Decatur, Ill., to Interoceanic Industries, Inc. (Minneapolis). Sale is the first step in a program aimed at getting Spencer Kellogg out of soybean crushing and further into the field of agrochemicals—a move Textron had in mind when it acquired the company in July.

Neville Chemical Co. (Pittsburgh) has acquired controlling interest in Western Organics, Inc. (Santa Fe Springs, Calif.). Merger will help Neville widen its line of hydrocarbon resins, solvents and plasticizers. Western manufactures chlorinated paraffins, hydrochloric acid and allied products.

Rio Algom Mines Ltd. (Toronto) is offering to buy out Rio Tinto Mining Co. of Canada (Toronto). One condition: that Rio Tinto Co. Ltd. (London, England) and its wholly owned Canadian subsidiary, Tinto Holdings Limited, will refer all Canadian business opportunities to Rio Algom for 15 years; Rio Algom will grant a reciprocal covenant relating to opportunities in the United Kingdom. Rio Algom will also grant to Tinto Holdings an option to buy 500,000 treasury shares of Rio Algom stock at $9.20/share.

Expansion

Cement: Permanente Cement Co. (Oakland, Calif.) is firming up plans for a $10-million cement plant near Helena, Mont. The company is associated with a group holding the prime contract for construction of the proposed Yellowtail Dam near Hardin, Mont.—a project requiring 1 million bbls. of cement.

Benzene: Mobil Chemical Co. has awarded Fluor Corp. Ltd. (Los Angeles) a contract for engineering, purchasing and construction work on benzene extraction facilities for Mobil's refining and petrochemical complex at Beaumont, Tex. (*CW, Sept. 24, '60, p. 21*). Fluor will build a 2,300-bbls./day pyrolysis gasoline hydrogenator, and a 12,500-bbls./day Udex benzene recovery unit. Completion is expected by next February.

Coated Paper: Great Northern Paper Co. (Boston) will invest more than $5 million for equipment to manufacture coated printing paper at its Mallinocket, Me., mill. Completion is expected by the end of next year.

Standard Packaging Corp. (Clifton, N.J.) will build a plant to produce metallized paper and paperboard for gift wrapping, labels and food cartons. Completion is due late next year. Cost: $4-5 million.

Specialties: Presstite Division of American-Marietta Co. (Chicago) has awarded contracts for construction of a plant to produce sealants, insulation and caulking compounds, and other industrial chemicals and specialties at Georgetown, Ont. Completion date: early next spring.

Sugar: Henderson Sugar Refining (New Orleans) plans to build a $12-million sugar refinery on Blakely Island, Mobile, Ala.

foreign roundup

Mergers/England: International Paints (Holdings) Ltd. and British Paints (Holdings) Ltd. have called off merger plans.

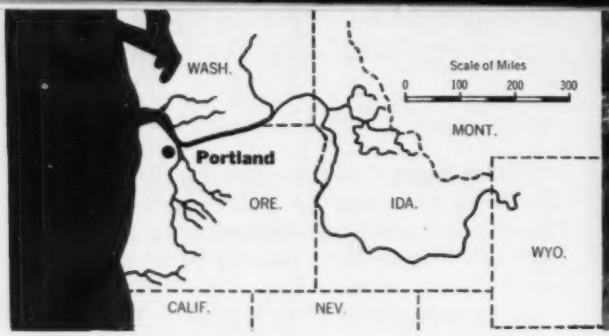
Unilever Ltd.'s bid for all issued stock of Pinoya Moldings Ltd. has been accepted by holders of 90% of the shares.

Hydrogen Peroxide/Spain: LaPorte Chemicals Ltd. has agreed to provide technical aid to the newly established Peroxidos S.A. for construction of an autoxidation hydrogen peroxide plant near Saragossa. Production is due to start in '63. Ultimate capacity: 1,500 long tons/year.

Catalysts/Japan: Japan Gas Co. and Universal Oil Products (Des Plaines, Ill.) have formed JGC-Universal Co., a 50-50 venture, to produce and regenerate UOP-type reformer catalysts. The joint company has plans to build a $2.6-million plant in Hiratsuka, Kanagawa prefecture, within a year after the government approves the terms.

Pharmaceuticals/Ghana: Hungary has agreed to supply Ghana with its first pharmaceuticals plant, which will form the basis for establishing the industry in that country. The new plant, due for completion in '63. will employ 200. Output will be tablets, capsules and injection media. Hungary will supply basic materials.

Rayon/Vietnam: Von Kohorn International Corp. (White Plains, N.Y.) has the approval of the Vietnam government for a feasibility study on a proposed rayon industry there.



Convenience to Northwest markets and a fine port have won for Portland enthusiastic support of specialties makers.

CW PHOTOS (BELOW)—HUGH ACKROYD

SOAPMAKER: Philip Feldman, 36, vice-president and operating chief of Mt. Hood Soap Co., a 50-year-old operation, says company holds 8 acres of Portland industrial property to meet anticipated growth requirements.

WAX PRODUCER: Clarence Chadwick, 53, general manager of Griffin Bros., cites firm's growth in industrial waxes as "not sensational but solid," sees big market opportunity in Portland's current building boom.

DRUGMAKER: George Foster, 45, vice-president and general sales manager of Stanley Drug Products for past 11 years, says company has jumped out of regional category, is now shooting for 50-state coverage.

COATINGS SPECIALIST: Adrian Adkins, 33, product manager, wood finishes, for Glidden's U.S. and Canadian operations, is now completing Portland lab for wood coatings research, has been in Portland 3 years.

PAINTMAKER: F. J. Hoffman, 50, recently named factory manager of Pittsburgh Plate Glass's expanding Portland operation, is already enthusiastic about company's prospects in mill-applied wood-coatings products.

FARM CHEMICAL EXPERT: Roy Miller, 73, left career as director of agriculture at Idaho Tech (now Idaho State College) to found farm chemicals firm in '20. He has started area's multiproduct aerosol filling line.

Portland: Northwest Specialties Hub

Last week Miller Products Inc., a company with a 41-year background in the agricultural chemicals business, completed installation at Portland, Ore., of the first nonpaint aerosol filling line for chemical specialties in the Northwest. The new installation aside from broadening Miller's business base, is another strong indicator of the growing importance of Portland as the specialties center of the Pacific Northwest.

The Miller expansion can be added to a lengthening list of chemical specialties operations in Portland. Now in the area are eight fertilizer manufacturers; 11 drug, medicine and toiletry manufacturers; 12 plants making insecticides and fungicides; 24 plants producing paints, varnishes and colors; and 21 in the soap and cleaning compound business. And, as the chart on p. 36 shows, there are numerous related CPI businesses based in Portland.

Specialties concentration in Portland is mainly due to its role as a distribution center for the Pacific Northwest. The highly navigable Columbia River, an excellent harbor (11th busiest in the U.S.), good rail and highway connections, all team up with a location central to the market to brighten the city's distribution picture.

Portland, with a population of 400,000 is the fourth largest industrial center† on the Pacific Coast. It sits in the center (about 140 miles from Seattle, 200 from the northern California border) of an area of over 250,000 sq. miles (excluding Canada and Alaska). It services the three states: Washington, Oregon and Idaho, which now have a population of more than 5 million. It is also handy to areas of western Montana, northern California, Vancouver, B.C., and Alaska.

As a distribution point it claims definite advantages over Seattle, its neighbor to the north. The prime one: present freight rates allow Portland distributors to reach about 2.6 million customers at a lower cost than can Seattle distributors; Seattle is favored for 1.9 million. The remaining 1 million or more in the tri-state market can be reached at about equal cost. Portland's growth as a distribution center is borne out by its 33.5% increase in general wholesaling since '55—more than twice the national average.

† Behind Los Angeles, San Francisco, Seattle.

The chemical specialties companies in the Portland area that CHEMICAL WEEK queried claim annual increases in gross sales in the last 10 years that range from as high as 20% to as low as 5%. Most mentioned a figure of about 10% yearly. This would be about par for the whole of Portland industry, which is now going through a transformation that should be watched by specialties marketers looking for new fields to exploit.

Out of the Woods: Business in Oregon has, traditionally, been dependent on just one industry—wood. Some 60% of the total business of the state comes from timber and wood products. In Oregon, Crown Zellerbach is the top employer, with around 5,000 on its payroll. In the past, any chemical specialties maker moving into the state had to recognize this fact and plan accordingly. Now, however, the situation is changing, due to the efforts over the last few years of Portland businessmen, a business-minded governor, and a professional state development group. They're making a concerted bid for Northwest industrial leadership.

The instability in one segment of the timber industry—plywood manufacture—can affect Portland's chemical specialties demand in the future. Plywood has fallen on hard times in recent years; despite rising sales, diminished profits are common. Last week, for example, sanded fir plywood price dropped $4/1,000 sq.ft. to the lowest point since the war. Production, however, has been at a record high. The profit shrinkage is forcing plywood people to look for ways to cut costs—and manufacture of their own resins for adhesives appeals to many. Recent price reductions in phenol, major ingredient in phenolic resins, has made this move more attractive. Manufacturers such as Georgia Pacific now make their own plywood bonding adhesives.

Painting a New Picture: Paintmakers eyeing the Northwest can also look for a changed picture in the future. The market for paints and protective coatings has long been tied to new construction and maintenance, since the area doesn't produce much in the way of finished products. However, there's a growing trend to mill-finish wood products. A whole new industry, in fact, is starting to mature, in which companies, such as Welsh Industries in Longview, Wash., buy wood products and finish them before moving them to market. (Welsh also does contract finishing for some of the major wood products companies.)

This could be a bright market for paintmakers if the trend is sustained. It's evident, however, that the same economic factor that pushed plywood manufacturers into the adhesive business—the profit squeeze — might also push finishers into the paint business.

In fact more than one small paintmaker in the Portland area has expressed to CHEMICAL WEEK his uncertainty about investing in new facilities for this market when he might lose his markets to captive production by wood producers. In spite of this risk, majors such as Pittsburgh Plate Glass and Glidden are now moving in. Glidden recently established a new board-coating lab to develop interior and exterior finishes for factory application to both boards and plywood.

Some Portland businessmen claim that the city's economy is not dependent, as first appears, on the fluctuations of the lumber, plywood and paper business. They claim most of the city's employees are in diversified, small-to-medium-size companies of 100 or less—a situation that tends

to reduce the impact of changes in wood products.

One of the leaders in developing Portland and Oregon business (Portland is the only city of over 100,000 population) has been governor Mark Hatfield (thought to be one of the Republican party's top leaders for '64), who is deep in industrial development. He has been helped by an aggressive State Dept. of Planning and Development in his efforts to help industries get started and to attract others.

No Runaways Wanted: The new business development appears to be professional and well thought out. The state stoutly maintains it doesn't want business that is trying to escape legislative restriction elsewhere. It will not offer tax advantages to new industry nor can it offer low-cost labor as a selling point. Average hourly manufacturing wage in Portland, for example, is $2.64, while the average rate in the primary metals field is $3.06/hour and $2.71 in the paper industry. Water and air-pollution regulations are strict, and an Oregon site usually means unionized employees.

Though they might appear drawbacks rather than business lures, these hard economic ideas have placed Oregon on a sound fiscal basis. Not only is the state devoid of a sales tax—a boon to retailers (retail sales exceed $2 billion yearly)—but it is also considered to have the best tax climate for industry of any of the Pacific Coast states.

A recent study conducted at the University of California at Los Angeles supports this. In the study, the hypothetical corporation had $1 million in assets, and did business in all four states — California, Oregon, Washington and Idaho. As UCLA worked out the problem, this corporation—which could well be a chemical one—would pay $23,757 in state and local taxes in California, $21,336 in Washington and only $18,897 in Oregon.

Since the new aggressive policies have been put into effect, a steady flow of distributors has moved into Portland. Not many manufacturers have moved in, but businessmen in Portland appear optimistic about the possibilities for its new distributors switching from product distribution to manufacture. This has happened several times and the favorable results is the basis for their optimism, they say.

Population the Key: Most specialty manufacturers in Portland say their own growth has been tied to the growth of the Northwest's population (a population that tends to be above average in education, income, and to be unfettered by ethnic traditions). The population growth is especially important to those companies that either market consumer specialties or turn out intermediates for such products.

There has been a rash of new multiple-unit dwelling construction in the last year and a half in the area. This, plus the growth of schools, offices and shopping centers is creating an expanding market for specialty makers.

In the heart of Portland, the "world's largest shopping center"—the $100-million Lloyd Center—is illustrative of the growth in retail marketing the area is experiencing.

New jobs are going to be the key to population growth, according to those who have studied the Portland area, and estimates see an over-all 23.4% increase in new manufacturing jobs in Oregon by '70. This will include an estimated 44.7% increase in plywood positions, 52.6% more jobs in the paper industry, a 53.6% increase in positions in primary metals and a whopping 310% increase in the electronics industry. Also slated for growth: the furniture, textile, printing, food processing, and service industries.

According to research by B. D. Thomas, president of Battelle Memorial Institute (Columbus, O.), the Northwest is in for a phenomenal growth. He estimates there will be 50 million people living between Eugene, Ore., and Vancouver, B.C., by the end of the century. This seems inconceivable to some of the residents, since it means increasing the population 10-fold in only 40 years—an increase of 25%/year.

Why Change? Not to be discounted in considering the Portland or Oregon areas as a possible site for population expansion is a certain "we like it as it is" attitude on the part of some of its people. The native Oregonian faces a conflict—he sees the need for stimulating economic growth but recoils at the thought of new arrivals despoiling the wonders of his environs.

Because of this ambivalence, there

Operating in the Portland area . . .

Air Reduction Co., Inc.	National Cylinder Gas Division, Chemetron Corp.
American-Marietta Co.	Nu Bora Soap Co.
Archer-Daniels-Midland Co.	Oregon Pulp & Paper Co.
Borden Chemical Co.	Oregon Washington Fertilizer Co.
Chipman Chemical Co., Inc.	Pacific Carbide & Alloys Co.
General Paint Co.	Pennsalt Chemicals Corp.
Glidden Co. of Oregon	Pittsburgh Plate Glass Co.
Great Western Printing Ink Co.	Portland Paint & Lacquer Products
Griffin Brothers, Inc.	Preservative Paint Co. of Oregon
Griffith Rubber Mills	Protective Coatings Corp.
Hercules Powder Co., Inc.	Rodda Paint, Inc.
Hollingworth Paints, Inc.	Sinclair & Valentine Co.
Huntington Rubber Mills	Snow Insecticide Co.
Industrial Air Products Co.	Stanley Drug Products, Inc.
McCloskey Varnish Co.	Stauffer Chemical Co.
Miller Paint Co., Inc.	Union Carbide Corp.
Miller Products Co.	Upjohn Co.
Mt. Hood Soap Co.	Voit Rubber Corp.

Oregon's Gov. Hatfield is a key figure in Portland's push for new industry.

has been a pattern of slow, leisurely growth. It's this tradition that business groups are working hard to change and they've been fairly successful. It is still a factor for any newcomer to keep under consideration, however.

Those chemical specialties makers in the Portland area to whom CHEMICAL WEEK talked appear to be doing well, look forward to improved business in the future. Miller Products, for example, which put in the new aerosol operation,* feels its new facilities will enable it to capture a good share of the estimated $4.05/-year each West Coast gardener spends on ag chemicals. Miller will start operation by making an insecticide and a mothproofer, follow up with a household deodorant, an insect repellant and a water repellant.

Last year the company moved into a new, $500,000 factory and warehouse on the edge of Portland. Its biggest competition locally comes from Ortho Chemical Division, California Chemical, which maintains its central distribution facilities and district offices for the Northwest in the city.

Griffin Brothers, a small company that makes over 15 varieties of industrial floor waxes, using everything from carnauba to acrylics, has seen what General Manager Clarence Chadwick, calls "fair growth; not sensational but solid." But Chadwick is quick to point out that a good potential exists in the area for hotel building as well as for supermarkets—prime buyers of janitorial supplies. Currently Griffin markets as far north as Vancouver, B.C., northeast to Great Falls, Mont., southeast to Salt Lake City and south to Sacramento, Calif.

Chadwick says that distribution as far east as Salt Lake City is economical; beyond that Eastern firms have a freight advantage. Major wax manufacturers from other areas ship industrial floor waxes into the area and some have moved in with distribution facilities.

All entries, according to Chadwick, have obtained a share of the market in line with the effort they have put in. He feels there are still unexploited markets in the region.

Toiletries Target: There are few drug and toiletries makers in Portland. Prime one is Stanley Drug Co., recently merged with Sperti Products (Hoboken, N.J.). It offers a full line of pharmaceuticals and proprietary items, including a new line of outdoor cosmetics. Prior to the merger Stanley had an annual sales volume of about $3 million.

Informed chemical observers feel that the Portland area could easily accommodate specialties manufacturers with toiletry lines consisting of almost anything from hand lotion to shampoo, since these items are now provided mainly by distributors.

There are now only two soap manufacturers in the Northwest: one in Seattle, the other in Portland. Phil Feldman, vice-president of Portland's Mt. Hood Soap Co., claims there is a greater per-capita use of soap in the Northwest than in other parts of the country. This is primarily due to the softness and purity of the water. The company, founded in 1902, has filled out its product line with liquid detergents, and manufactures a full line of cleaning compounds.

Feldman sees one great disadvantage in the vast marketing territory his company covers. Unlike Eastern areas, Western population centers are small and spread apart and sales costs zoom with a narrow product line. Feldman maintains that to succeed in the Northwest a specialty maker must have a rounded line to simplify the problems of his jobbers.

Nine years ago, Mt. Hood started a new company, United Chemical, to operate as a distributor for major chemical firms. This move has paid off handsomely with growth averaging 20-25% yearly, with no sign of a slowdown.

Portland enthusiasts like to regard United as a typical example of how the area's market potentials can be exploited. They feel that the area has much to offer other newcomers in chemicals—things such as combined retail and wholesale business of over $3 billion annually; household growth up 20% (to 275,000) since '50; an 85% urban population; 2,000 manufacturing firms; and geographical isolation from other marketing areas.

There are now more than 75 regional and national firms maintaining Northwest headquarters in Portland, and there will doubtless soon be more as the area evolves from its one-industry orientated economy into a multi-industried, dynamic marketplace for both industrial and consumer goods.

Sprayed Interiors

Chemicals may find another niche in the automotive industry if the development of a Canadian "spray upholstery" process is commercially successful.

Three Scarboro, Ont., men, comprising the International Fibrecrafts Systems, plan to go into business in Toronto first and later in the U.S. to refurbish worn car interiors at a cost of around $40 to $50. It's done by spray-painting with fiber. Everything can be done except the seats, and Sam Miller, company president, quotes a $12 fee for roof liners, $3 for individual arm rests. These prices, he notes, are considerably less than what most car dealers or upholstery repair shops would charge.

The actual process is simple: any man-made or natural fiber, can be cut to fit in a special "gun," which is passed over the to-be-upholstered surface, already coated with a special resin adhesive. Fabric particles (1/32 to 1/4 in. long, depending on effect wanted) are propelled electrostatically onto the adhesive.

Fiber-spray painting isn't new — "flocked" fabrics have been applied this way to rubber gloves and girdles for years. This, however, seems to be the first application for automobile interiors, and could provide a tidy specialty glue market.

* There is already an aerosol paint filling operation in Seattle.

Jersey Standard's main offices in New York . . .

New York offices (left, above) of Standard Oil Co. (New Jersey) contrast sharply with converted nursi

Circumspect CPI Hunts Havens

To probe new ways of protecting employees against radiation fallout, management representatives of 20 Standard Oil Co. (New Jersey) affiliates met recently at their company's emergency headquarters near Morristown, N.J. Like many chemical process companies, Jersey Standard is translating into action its concern over the fallout threat.

Several years of effort and $0.5 million have already gone into Jersey Standard's rural "remote-control center," a converted nursing home (see *picture*) designed to house key headquarters staffers, preserve vital records and to maintain company-wide communications in the event the firm's New York base becomes untenable as the result of enemy attack. Now a much broader program involving the firm's widespread offices and plants is being worked out as a result of the recent meeting. First step in this undertaking: searching existing facilities for potential shelter areas.

Taking Stock: Jersey Standard isn't alone in its planning. Companies now making similar studies include W. R. Grace; Hooker Chemical; Hercules Powder; American Cyanamid; Du Pont (via its Central Safety Committee); Union Carbide; Monsanto; Chemetron; International Minerals & Chemical; U. S. Industrial Chemicals; and others.

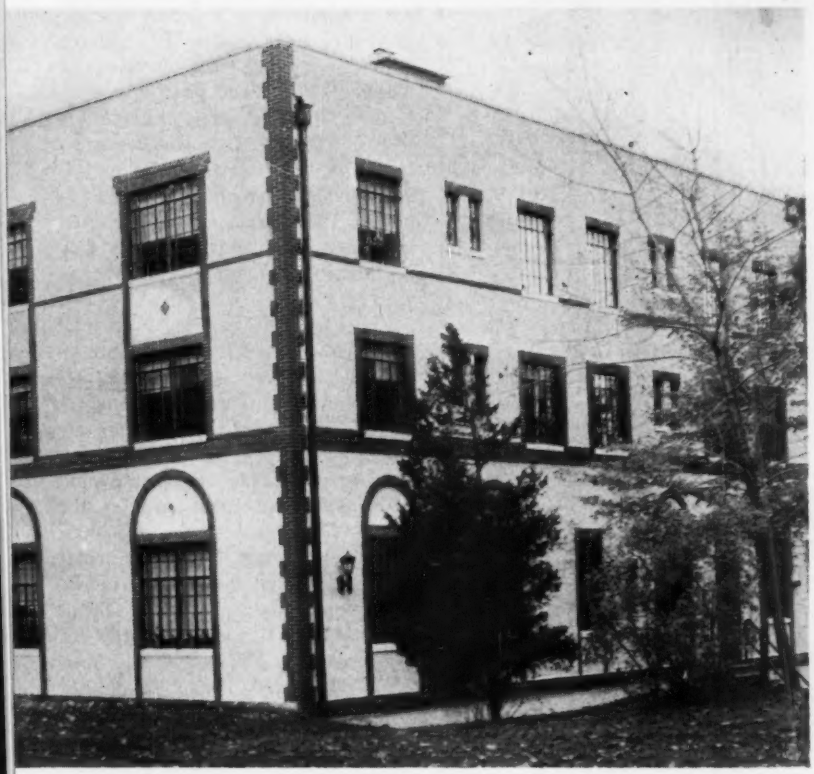
Aerojet-General (Azusa, Calif.), for example, is evaluating buildings on its property to determine which are most resistant to blast and radiation. Aerojet's emergency plan is supported by a 200-bed emergency hospital (at the plant site), a portable first-aid station, an ambulance, etc.

Swift & Co. (Chicago) has instructed all plant managers to immediately reorganize and reindoctrinate first-aid teams; post plans of plant areas designating shelter points; and set up emergency personnel charts with addresses and phone numbers.

Victor Chemical's Chicago Heights plant is a member of the Chicago Heights Manufacturing Assn., which has an emergency plan covering all types of disasters, natural and man-made. A company in this area can thus coordinate its plans with those of other plants in the area.

Building Shelters: Several companies besides Jersey Standard have either built special fallout shelters or

. . . would be superseded as company control center by these emergency headquarters 30 miles away.



home (right) in Morristown, N.J., which can accommodate 130 staffers.

From Radiation Peril

plan to do so, according to a nationwide CHEMICAL WEEK survey.

Rohm & Haas has constructed shelters in its plants at Knoxville, Tenn.; Bristol and Bridesburg, Pa.; and the Houston Ship Channel. (A cafeteria in the last-named shelter holds 200 employees). Cleveland Twist Drill Co. has spent $200,000 on an employee shelter, worked out air-purification details with Mine Safety Appliance Co. (Pittsburgh).

Stanford Research Institute (Menlo Park, Calif.) says its basement shelter "offers adequate protection from both blast and fallout for any type of attack expected in the Bay Area." There is a total of 13 in. of concrete in the roof and two floors above the basement. The basement floor is an average of 15 ft. below grade and is shielded (by the ground) from radiation. Reasons SRI: "If the Bay Area were attacked, the effective radiation dose might reach a maximum of 25,000 roentgens (R). Were this upper limit of radiation present in our area, personnel in the basement would receive a total dose of 100 R, which is the minimum sickness dosage of radiation." Under less severe conditions, even the sickness dosage would be prevented.

Construction has also begun on a sealed (a slight overpressure of air prevents inward leaks) chemical, biological and radiation shelter at the American Chemical Society headquarters in Washington.

U. S. Borax (Boron, Calif.) is making underground mine facilities available as a survival shelter to civilian and military people of Boron, North Edwards, and Edwards Air Force Base. Company and Air Force officials have been talking about the idea for two years, will continue planning to determine what equipment and services will be needed. As things stand, thousands of persons can be accommodated. But they'll need to bring their own "survival kits" (food, blankets, etc.).

In a similar idea, Puritan Chemical Co. (Atlanta) is "rehabilitating" a tunnel that leads from the back of its plant to a nearby railroad. A spokesman says leaks and other trouble spots have been eliminated so that the tunnel could be readily converted into an equipped shelter.

Alfred E. Stepan, Jr., president of Stepan Chemical, views fallout protection for employees as a serious corporate responsibility. Recently returned from a three-day visit to East Berlin, he is putting top manpower on a crash antifallout program. At Stepan's Maywood Chemical Works division (Maywood, N.J.) an ultramodern, closed-air-system shelter is now being designed. Maywood General Manager (and Stepan vice-president) D. H. Francis calls fallout "a real hazard," thinks Maywood has "better insight" than most companies into the shelter problem. His company's experience in helping make submarine air purifiers (specifically, the removal of carbon dioxide) will be valuable in the shelter design. Francis believes merely filtering outside air isn't safe enough protection against fallout.

Union Bag-Camp Paper Corp. (Savannah, Ga.) is also considering construction of special protection facilities for its 5,300 workers. A spokesman observes: "The decision on what type of protection we can and should provide in a plant of this size (75 acres of buildings) is no little task. We plan to begin talks with our industrial engineers right away. And, in the meantime, management is giving a lot of thought to what we may do in the very near future."

No Place Like Home: Although it is building no special shelters for employees, Hercules Powder has "so-

is the only way

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N. Y. Coliseum, Nov. 27—Dec. 1, 1961

MANAGEMENT: International Exposition Company, 480 Lexington Ave., N. Y. 17, N. Y.

phisticated" disaster plans at its widely dispersed plants, figures it would be back in business four days after a nuclear attack.

Manager of Security Frank L. Dougherty says the company feels it has a responsibility to encourage employees to build shelters at home and is promoting this idea in company literature. A one-act play written by Dougherty, "Who Wants to Live?" has had wide distribution in the company. It begins, "The scene of this play is laid in the home of a Hercules employee. The characters are the father, mother and five children. They may be described as a typical American family."

The play's dialogue gives essential information on fallout shelters, including construction, supplies ("Remember grandma's pantry, its shelves loaded with food, ready for any emergency". . .), and equipment. Recommended: the family radiation measurement kit, developed by the Bendix Corp.*

Nothing Doing: Some companies report little or no interest in a fallout protection program. Among them: Socony Mobil, Heyden Newport, Gulf Oil, Dow, and Diamond Alkali, Shell Chemical (Deer Park, Tex.) and Phillips Chemical (Pasadena, Tex.)

A West Coast production manager says, "We've got better things to do with our time and money. This country is on the offensive, not the defensive."

In Cleveland, the Office of Civil Defense Mobilization reports little demand by plants for its abundant literature on the design and construction of big shelters. The prevalent feeling seems to be that fallout shelters would do little good in this critical target area. A nuclear bomb, on target, would level about 9 square miles of Cleveland's industrial "flats," according to local estimates. Comments one native, "In event of attack we'd just do what everyone else would—prav."

Of course, many plants include fire drills and plant-wide evacuation programs in their regular safety programs. Shamrock Oil & Gas's McKee plant (near Dumas, Tex.) had its first such disaster drill recently, plans to

* The kit consists of a ratemeter, which measures the rate of radiation fallout; a dosimeter for measuring the amount of radiation a person accumulates; a charger that resets both meters, and an instruction manual. It costs $24.95, is available from Atomic Accessories, Inc., 811 West Merrick Rd., Valley Stream, New York.

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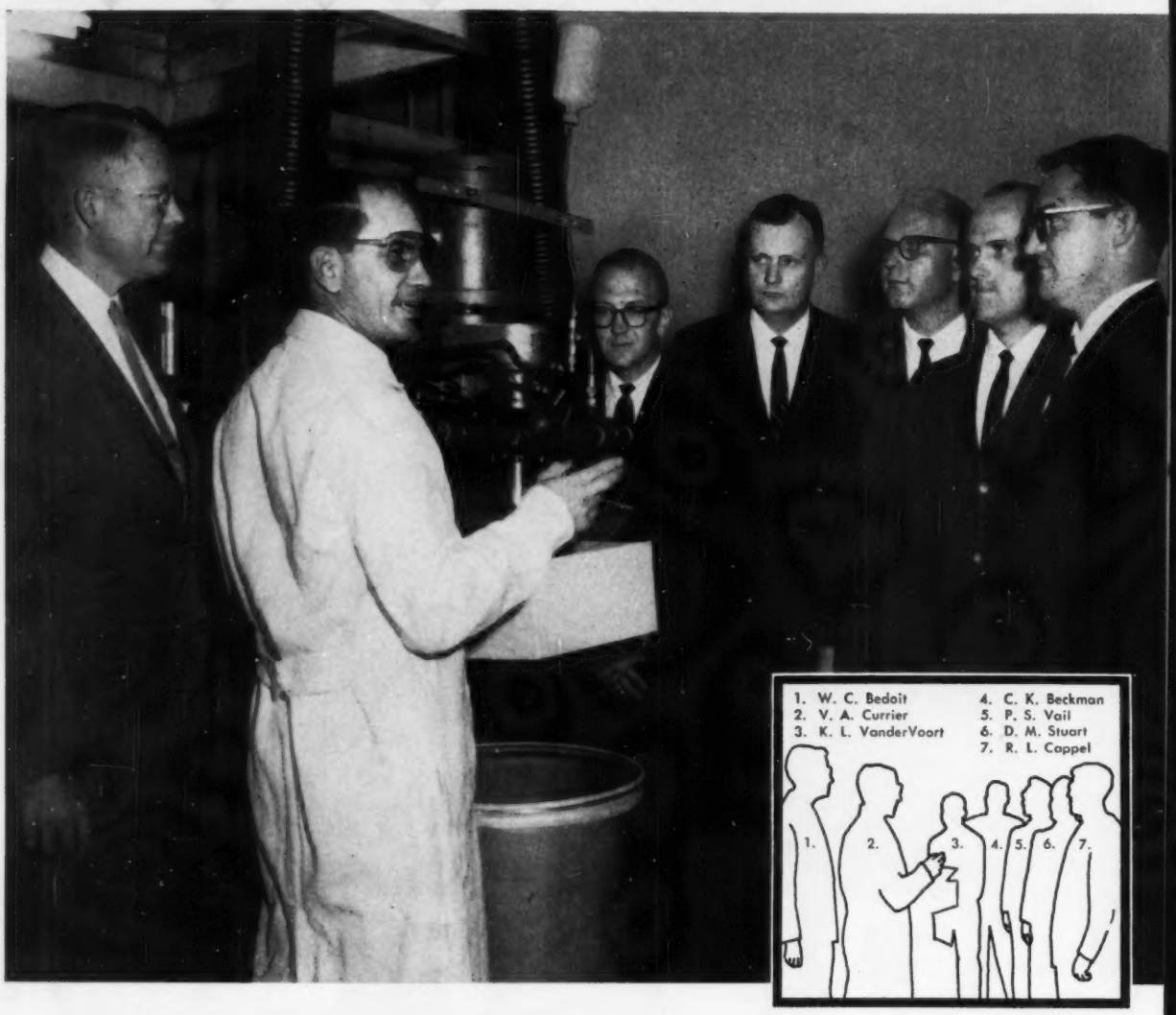

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ERS and CATALYSTS

SPECIFICATIONS

		PPG[1] 400	PPG 2000	Triol G-400	Triol G-700	Triol G-1500	Triol G-3000	Triol G-3250	Triol G-4000
Acid No., mg. KOH/g.	max.	—	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Appearance		Clear and substantially free of foreign matter							
Ash, wt. %	max.	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Color, Pt-Co	max.	75	50	100	100	100	100	100	100
Gel test, flow time, sec.	max.	—	10	—	—	—	10	10	10
Hydroxyl No., mg. KOH/g.	min.	—	54.5	375	229	107	53.4	50.5	39
	max.	—	57.5	450	253	118	59.0	53.5	43
pH in 10:1 methanol-water solvent	min.	5.0	5.0	5.0	5.0	3.5[2]	5.0	5.0	5.0
	max.	7.0	7.0	7.0	7.0	5.5	7.0	7.0	7.0
Potassium, ppm.	max.	—	10	50	10	10	10	10	10
Specific gravity, 20/20°C.	min.	—	1.003	—	—	—	—	—	—
	max.	—	1.006	—	—	—	—	—	—
Total unsaturation, meq/g.	max.	—	0.04	0.03	0.03	0.03	0.04	0.04	0.075
Viscosity, SUS at 100°F.	min.	150	—	—	—	—	—	—	—
	max.	175	—	—	—	—	—	—	—
Volatility, wt. %	max.	—	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Water at shipment, wt. %	max.	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1

[1]A urethane grade of Polypropylene Glycol 400 is available upon request.
[2]10:6 isopropanol-water solvent used.

	N-METHYLMORPHOLINE	N-ETHYLMORPHOLINE	[3]N,N'-DIMETHYLPIPERAZINE
Appearance	Clear and substantially free of foreign matter		
Boiling range, ASTM, °C.			
IBP:	112.0 min.	133.0 min.	125.0 min.
DP:	118.0 max.	141.0 max.	135.0 max.
Color, Pt-Co scale	15 max.	15 max.	75 max.
Color after 24 hours, 4 parts sample, 6 parts water, Pt-Co scale	35 max.	—	—
Purity, wt. %	99.0 min.	99.0 min.	Equivalent weight . . . 57 min.
Specific gravity, 20/20°C.	0.917 min.	0.912 min.	59 max.
	0.922 max.	0.916 max.	—
Water, wt. %	0.30 max.	0.2 max.	0.5 max.
Other amines, wt. %	—	—	0.5 max.

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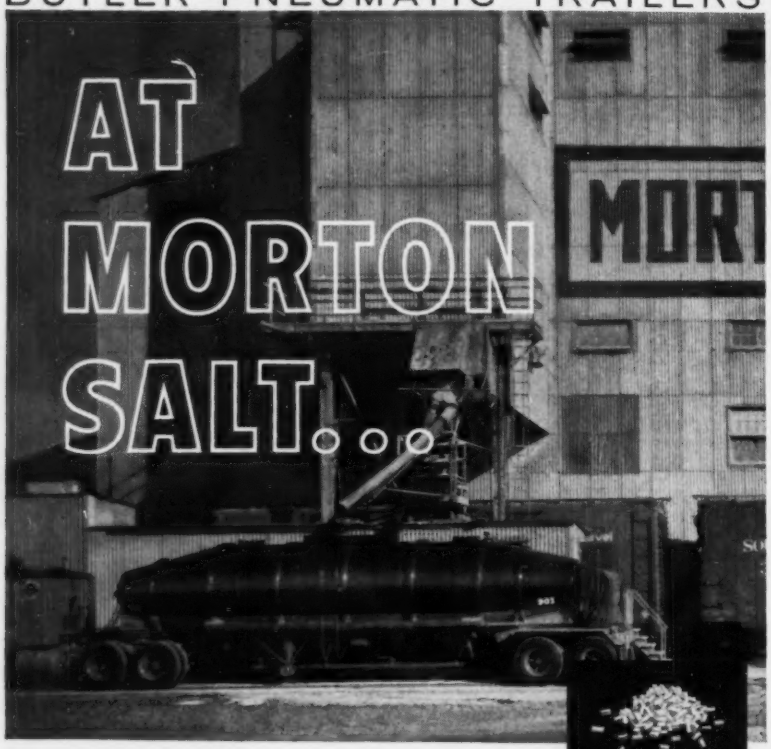

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tie future drills in with Phillips Chemical plants at Etter and Borger, Tex.

Testing Boom: Renewed Soviet nuclear bomb testing is raising some old questions about fallout that could influence decisions to build shelters. For one thing, it's still not certain how much radiation is tolerable—even nonlethal doses will cause genetic effects. And strontium-90, building up in food and bones, is a hazard in any concentration. Some manufacturing (e.g., photographic film materials) processes can be harmed even by test fallout.

So far, nucleomitophobia (fear of atomic energy) hasn't become endemic among plant managers. Many are taking what they call a "realistic view," working closely with civil defense officials, but not plunging heavily into shelter construction. One security official admits his job involves "a middle-road approach to fallout defense, rather than all-out effort."

But companies that have built or are building fallout shelters feel they're being even more realistic. The international thunder clouds, they reckon, could become mushroom clouds at any time.

KEY CHANGES

Robert O. Koch to vice-president and general counsel, Texas Gas Transmission Corp. (Owensboro, Ky.).

Walter C. Bauer and **Thomas B. Gibson** to assistant secretaries, **Gleason W. Coleman** to assistant controller and assistant secretary, Stauffer Chemical Co. (New York).

John M. Dumser to assistant to the president, Bridgeport Brass Co. (Bridgeport, Conn.).

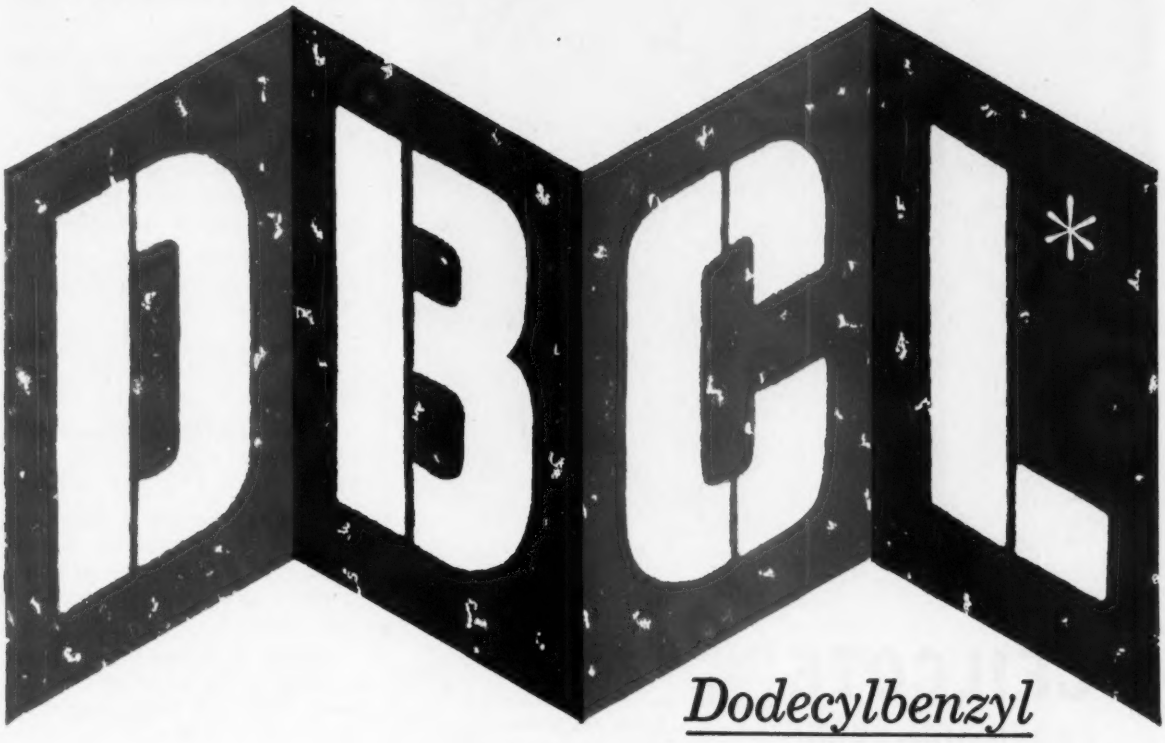
Henry C. Goodrich to the board of directors, Rust Engineering Co. (Pittsburgh).

Fred C. Foy to the board of directors, Courtaulds North America, Inc. (New York), producer of fibers and chemicals.

Philip S. Hessinger and **Adolf J. Strott** to vice-presidents, National Beryllia Corp. (Haskell, N.J.).

William A. Corry to vice-president (manufacturing and development), Coated Fabrics Division of Interchemical Corp. (Toledo, O.).

CONOCO



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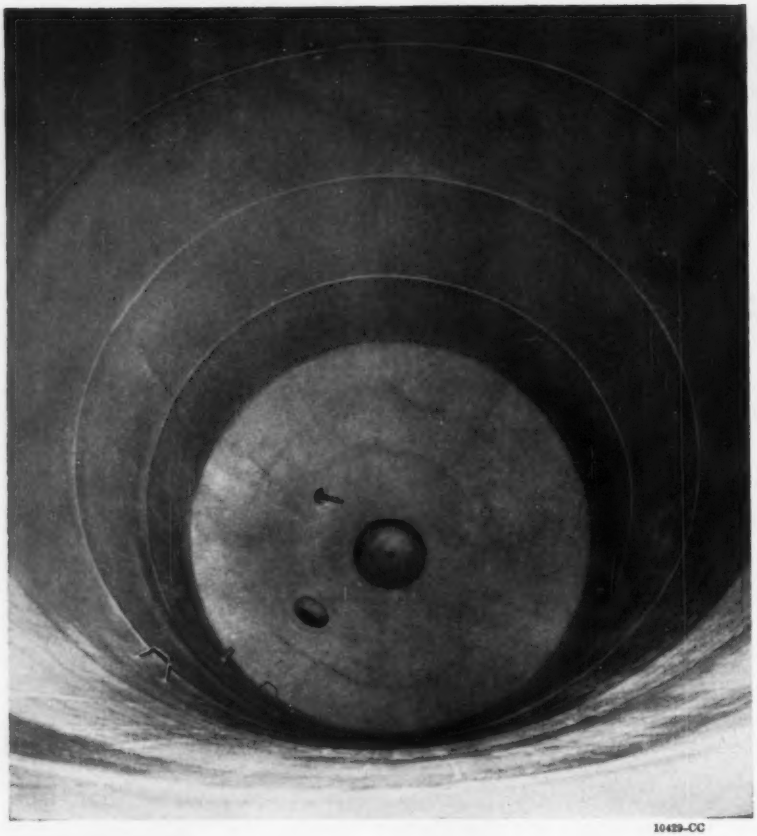

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Charles D. Michaelson to vice-president (mining), **Gordon B. Russell** to treasurer and comptroller, Kennecott Copper Corp. (New York).

G. R. Preston to vice-president, Cities Service Petroleum Co. (Bartlesville, Okla.).

B. Nevling Clune to vice-president and general manager (Scale Division), Fairbanks, Morse & Co. (Yonkers, N.Y.).

A. L. McMullen to vice-president and general manager, Seiberling Rubber Co. of Canada, Ltd. (Toronto).

Arthur Snyder, Jr., to controller, Behr-Manning Division of Norton Co. (Worcester, Mass.).

Charles R. Cox to the board of directors, Firth Sterling, Inc., (Pittsburgh).

C. Gordon Jelliffe to vice-president, The Borden Chemical Co. (New York).

Alfred E. Grazen to president and general manager, Sterling Electric Motors, Inc. (Los Angeles), subsidiary of Hathaway Instruments, Inc. (Denver).

Thomas A. Fearnside and **Arthur J. Good** to the board of directors, Stone & Webster Engineering Corp. (New York and Boston).

Frank Edlund to vice-president, J. H. DeLamar & Son, Inc. (Chicago), distributor of fine chemicals.

John H. Weitz to president, Independent Explosives Co. (Cleveland).

R. I. Preuit and **R. W. Goeldner** to vice-presidents, Aqua-Chem, Inc. (Waukesha, Wis.), affiliate of Cleaver-Brooks Co.

Charles S. Brown, Paul Gerden and **Fred J. Kirchmeyer** to vice-presidents, Abbott Laboratories (North Chicago, Ill.).

Kenneth R. Woolard to assistant treasurer, Chemstrand Corp. (Decatur, Ala.).

Henry H. Maltbie to vice-president and general manager, Specialty Valve, Trap & Controls Division of White Sewing Machine Corp. (Cleveland).

Paul L. Fahrney and **Elmer R. Peterson** to the board of directors, **J. T. Higgins** to vice-president, Standard Oil Co. of California (San Francisco).

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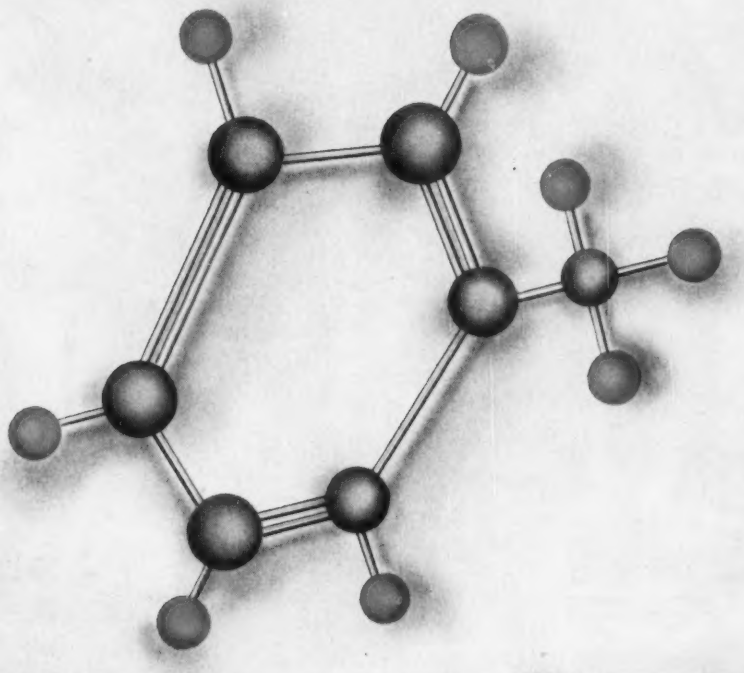

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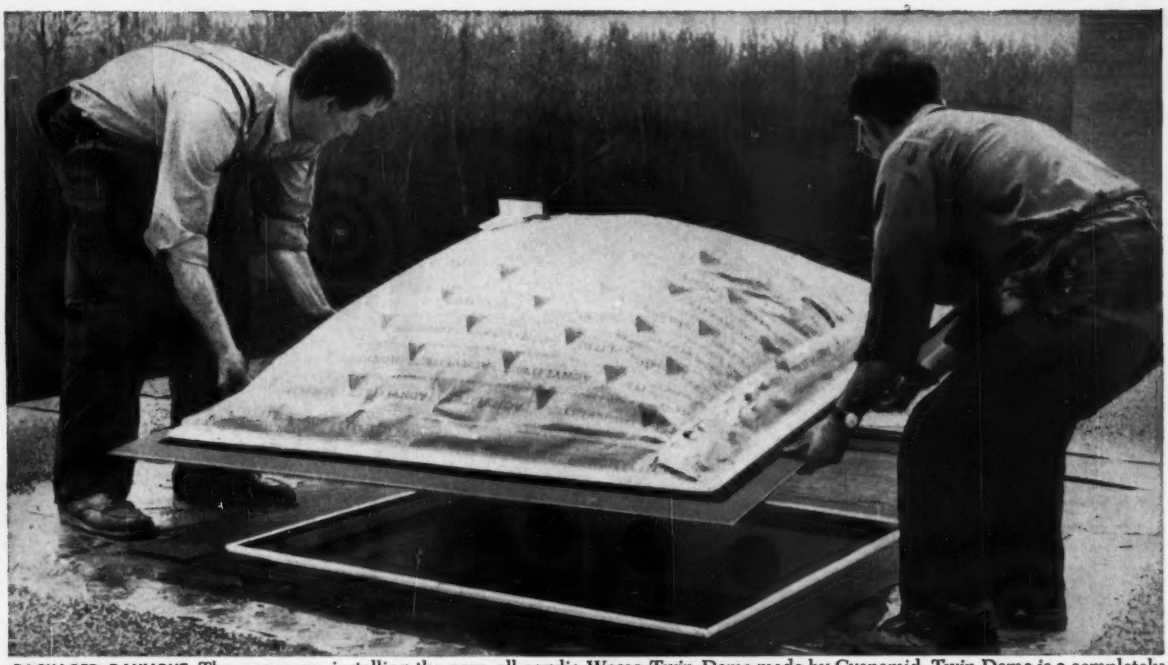

PACKAGED DAYLIGHT. These men are installing the new, all-acrylic Wasco Twin Dome made by Cyanamid. Twin Dome is a completely sealed, insulated, shatterproof, low-profile skylight with inner and outer domes available in any combination—clear, colorless, white translucent or reflective—to allow maximum control of light levels and heat gain. The domes are bonded to an aluminum nailing flange for easy installation and have an inch of "dead air" between them for exceptionally efficient insulation against heat and cold.
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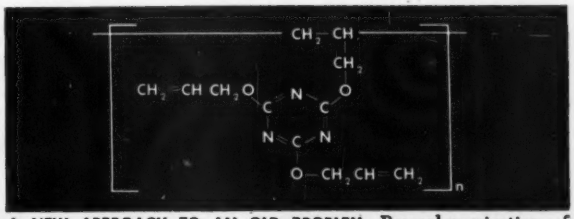

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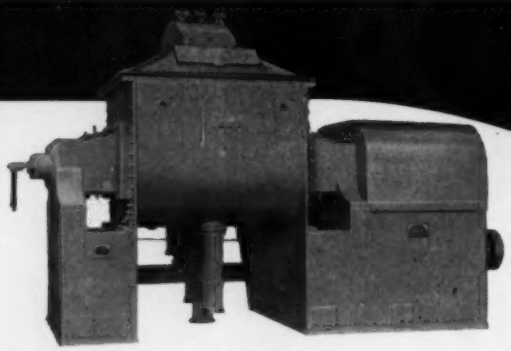

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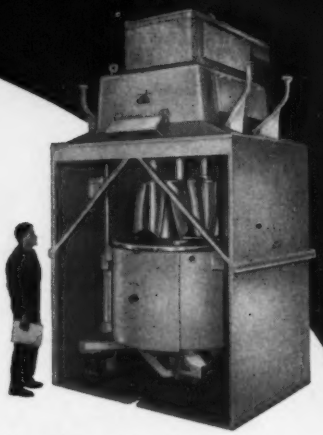

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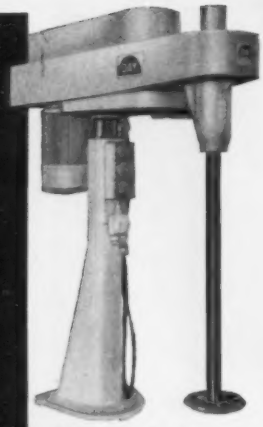

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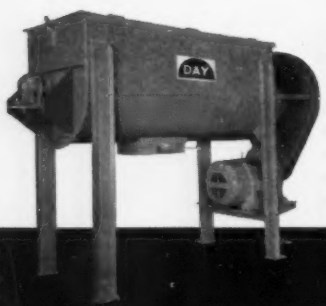

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DAY

Washington
Newsletter

CHEMICAL WEEK
October 14, 1961

The Du Pont stock case may end up in the Supreme Court for the third time. Observers see this as a distinct possibility if federal district court in Chicago goes along with the latest Justice Dept. proposal to divorce Du Pont from General Motors. The government demanded that Christiana Securities Co. also be ordered to divest itself of GM holdings. This came as no surprise. But it probably will call for further legal proceedings since the Supreme Court never has ruled on Christiana's relations with GM.

This is the situation: Christiana, controlled by Du Pont family interests, holds nearly 30% of Du Pont's common shares. The government contends that because of this relationship a group of 65 individuals and organizations could end up with control of 8% of GM's shares. And this, in the mind of government trustbusters, is too much. Justice Dept. attorneys often have indicated that they do not want Du Pont's control over GM "reconcentrated" in Christiana.

•

Bids for a fourth saline water demonstration plant are being accepted by the Office of Saline Water. This will be the 1-million-gal./-day brackish water conversion unit at Roswell, N. M. The invitation covers construction of a forced-circulation vapor-compression distillation plant, with an operating building and facilities and technical services for a 75-day test period. Bid opening: 3 p.m. Dec. 5 at Interior Dept.

The government's first demonstration plant—the 1-million-gal./day long-tube distillation plant at Freeport, Tex.—is in operation. The 250,000-gal./day electrodialysis brackish water plant at Webster, S. D., will be dedicated Oct. 20. The 1-million-gal./day multistage flash distillation plant at San Diego will be completed next month. Of the originally authorized five demonstration plants, only the 250,000-gal./day freeze-process unit at Wrightsville Beach, N.C., is still in the design state. But the new saline water program gives OSW $12.5 million/year to spend on demonstration plants. Upshot: more plants, to test other processes, undoubtedly will be built in the not-too-distant future.

•

Export licenses for shipments to Iron Curtain countries have declined by nearly 50% this year, says the Commerce Dept. Figures indicate that the chief reason for the drop was receipt of fewer applications. There actually has been little change in policy on approving or rejecting such applications, and the ratio of denials to approvals has remained about the same as under the Eisenhower Administration. In the past, exports of chemical products—particularly fertilizers—have made up a good share of the Iron Curtain trade.

•

The issue of private ownership of fissionable materials seems likely to come to a head in the next session of Congress, starting in Jan-

Washington Newsletter

(Continued)

uary. At present, the government owns fissionable materials and leases them to private industry—at what amounts to subsidized rates. It has been proposed that private ownership be permitted to (1) avoid a buildup of large government inventories and (2) help get away from establishing reactor fuel costs on a subsidized basis.

The Atomic Energy Commission is now engaged in a study of the entire question. Commissioners hope to have their recommendations ready by the time Congress reconvenes in January. Most private groups contacted so far favor continuation of the present leasing system.

•

Simplified air freight rates on chemical and other products stand a good chance of winning Civil Aeronautics Board approval. In many cases, lower rates would result. Involved is a new tariff proposal filed by American Airlines to fix rates on the basis of weight alone, regardless of a shipment's contents. Under the present complicated system, rates differ for hundreds of commodities—depending on their classification.

Here is an example: under its proposal, American would charge $23.75/100 lbs. for a shipment from New York to Los Angeles. Present rates are $28.55 on pharmaceuticals, $26.60 on chemicals in bulk (either liquid or powder), and $31.77 on fertilizers and on plastic moldings, rods, sheets and tubes. Conversely, rates would tend to be slightly higher on short hauls. American's proposal is scheduled to go into effect Oct. 23, if CAB approves.

Extent of Federal Trade Commission authority in demanding confidential company information should be clarified by a Supreme Court decision during the term that started last week. Involved is the St. Regis Paper Co. and its acquisitions. FTC, checking into the legality of the acquisitions, asked St. Regis for copies of confidential documents it had submitted to the Census Bureau. The company balked and FTC took the case to court. What the Supreme Court will decide basically is whether information prepared for the Census Bureau should be made available, on demand, to other government agencies. Implications to the CPI and other industries are wide.

•

A preliminary investigation into the aluminum industry has been undertaken by the Senate Antitrust and Monopoly Subcommittee. It has issued subpoenas for documents to 20 companies, mostly fabricators. Major primary metal producers—Alcoa, Kaiser and Reynolds —have not been subpoenaed. It is understood that the subcommittee, headed by Sen. Estes Kefauver (D., Tenn.), is acting on complaints from extruders about primary metal prices.

The subcommittee, interested in prices and the extent of fabricating activity by primary metal producers, wants to determine if a full-scale Congressional investigation is warranted.

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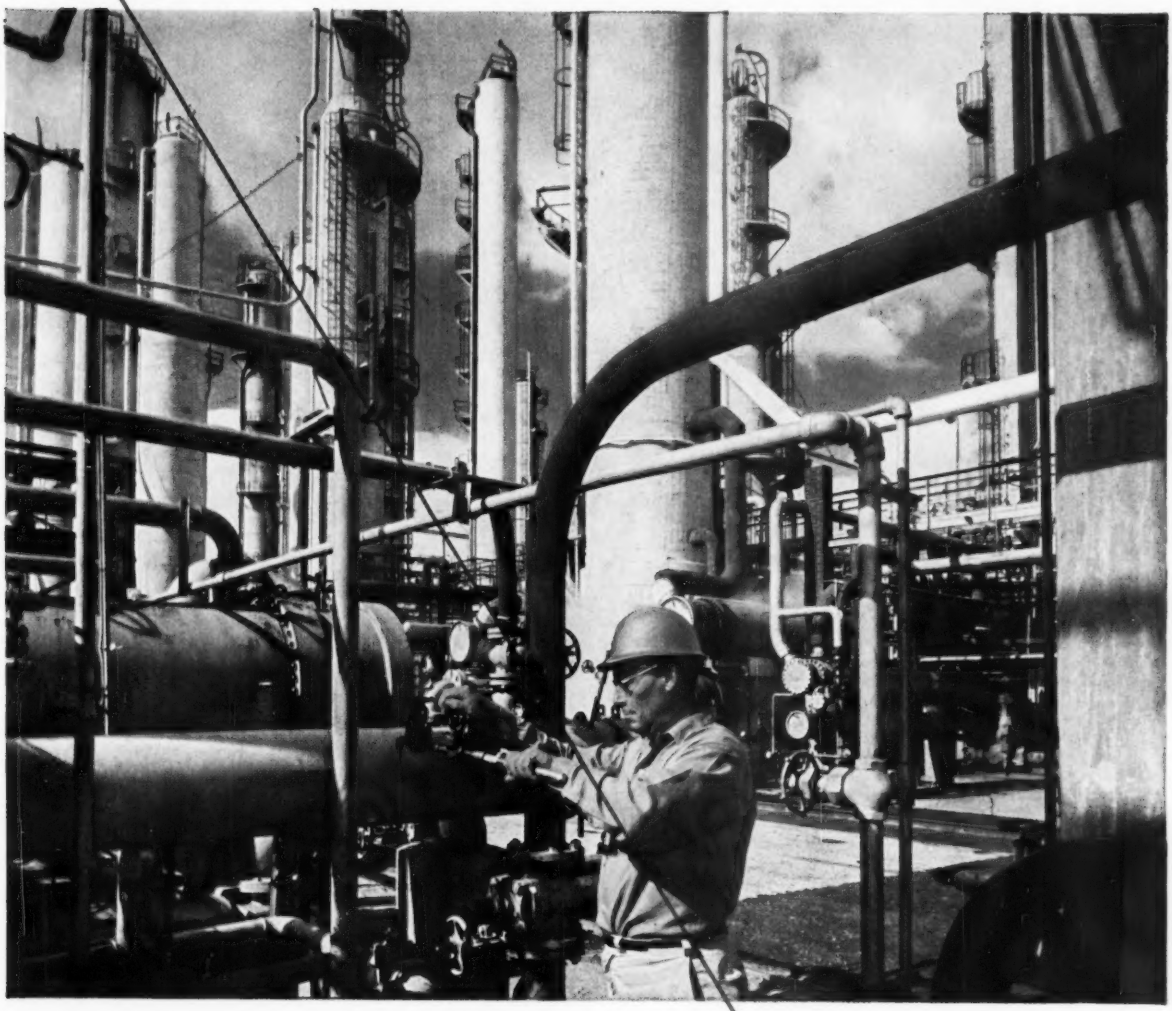

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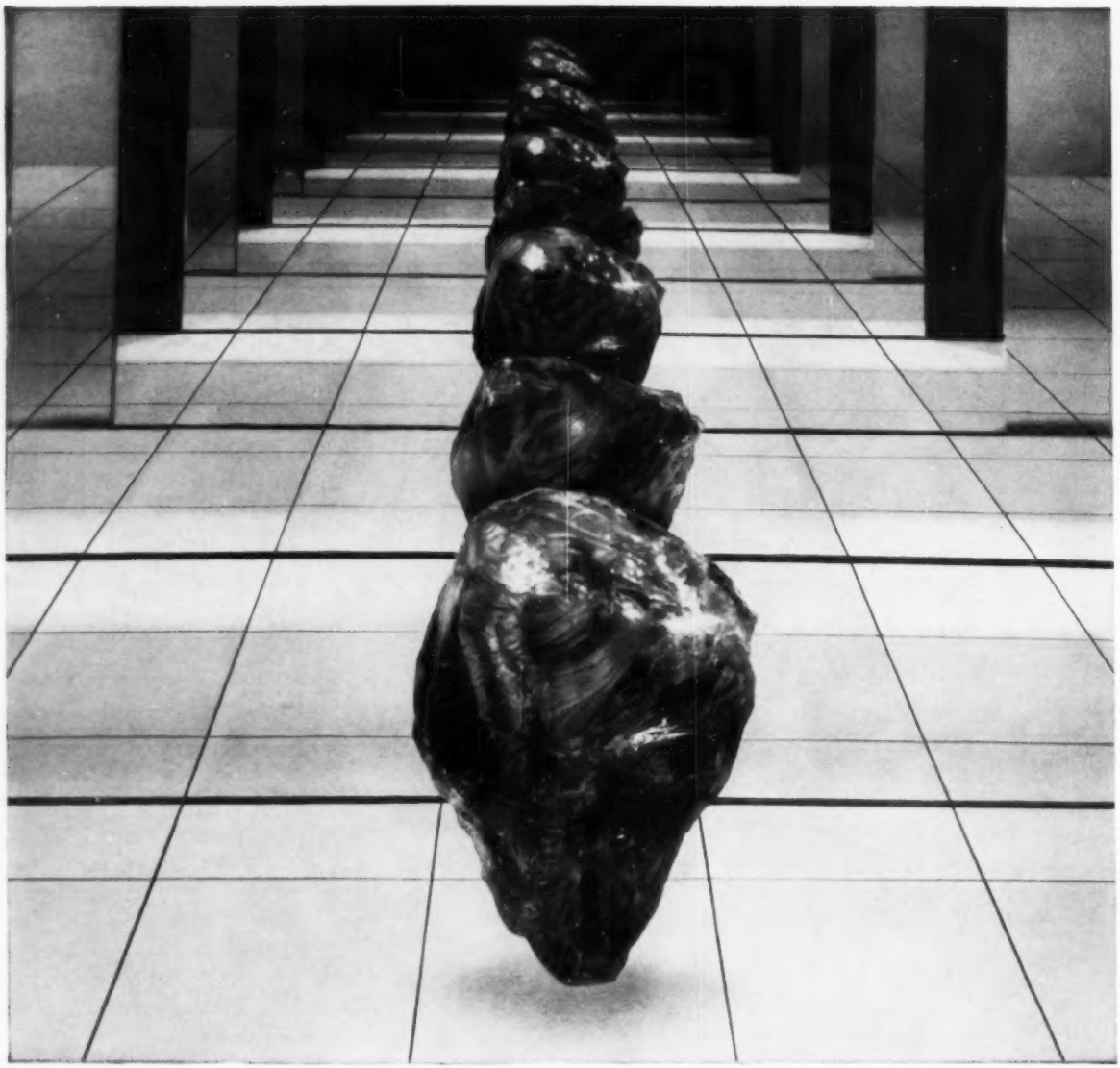

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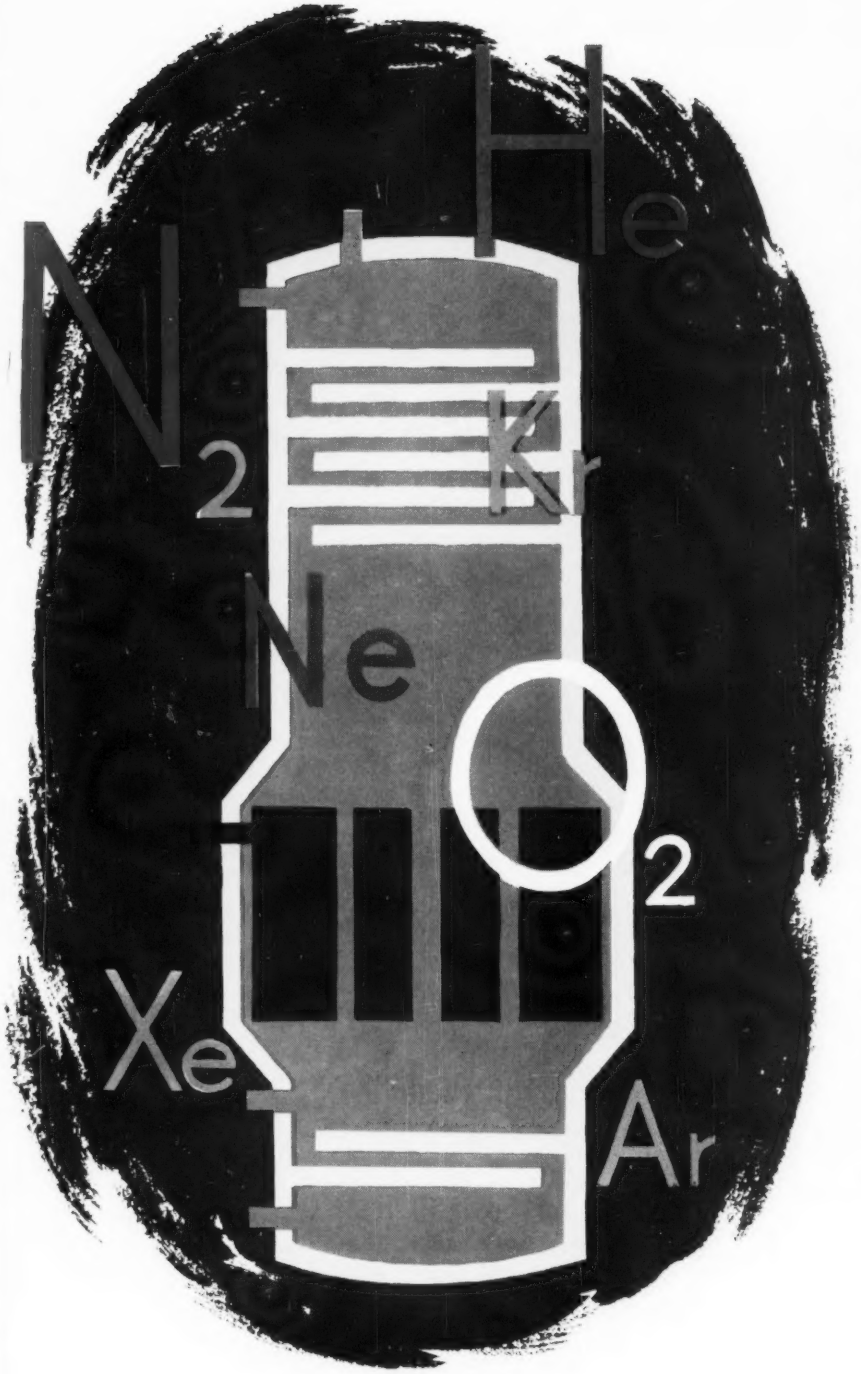


CW Special Report

The air-separation column—represented by the abstraction at left—is the heart of the cryogenic-industrial gas industry. The column fractionates liquefied air into its components: oxygen, nitrogen, argon, neon, krypton and xenon. Some helium is also produced this way. Similar "cold box" techniques are employed in large-scale helium (from natural gas) production and in purifying certain hydrogen and hydrocarbon streams. These procedures have been adapted to manufacture of liquid hydrogen and will be the key to successful launching of proposed multimillion-dollar projects for transporting and storing liquefied natural gas.

CRYOGENIC GASES

They account for sales of $520 million/year. The business has tripled in the last 10 years, should double in the next 10. But growth is bringing more competition and more problems. Turn page for start of special report. ▶

CRYOGENIC GASES
CW Special Report

The Challenge: How to Move More and More Products

Statistics (*p. 57*) clearly show that the cryogenic-industrial gas industry is booming. Sales (of product and equipment) came to slightly more than $400 million in '58. Last year they had risen to $520 million. Present indications are that '65 sales should hit $725 million. And sometime before '70 the industry should be a $1-billion/year business.

But the plain dollar figures don't show the steady undercurrent of problems facing the industry. At the heart of the matter: although handling fluids at low temperatures is a tricky business involving a great deal of specialized know-how, a number of firms have developed competence in the area, and competition for almost all aspects of the business is fierce. This has helped to drive costs down and has broadened the market. But it has also left producers on a treadmill, trying to move more and more products to maintain profits.

Other problems in the industry are all corollary to that. Lowered profit margins cause complaints by some that they're not able to plow enough money back into research to develop new applications. And that type of work, they say, is essential to the long-range future of the entire industry. Also, to gain economies, companies are building bigger plants. This trend is particularly noticeable in the air-separation business, where once-economical plants are now marginal operations. Some firms with only small plants are feeling the squeeze in particular.

Falling profit margins are, of course, an increasingly familiar story in the CPI. The cryogenic-industrial gas industry is better off than most. There are enough new applications in sight for its products to insure more-than-substantial growth over the next decade at least. Older uses are growing, too. In short, the industry, in spite of its problems, is in a fine state of health.

Matter of Names: Crucial to any understanding of the industry, its prospects and problems, is the matter of definition. "Cryogenic" is derived from the Greek word, *kryos,* meaning icy cold. But icy cold means different things to different people.

Some in the industry prefer the term "industrial gas." The trouble with that definition is that it encompasses such products as acetylene and carbon dioxide, which are not processed at low temperature. And while many companies produce these, along with oxygen, nitrogen and others, the common denominator is more in marketing than anything else.

The term cryogenic-industrial gas, for purposes of this report, means products sold either as liquids or as gases, which, at some point in their history, have been processed at below —200 F.* The industry is concerned not only with making and marketing these products but also with engineering plants to produce them and with employing similar techniques to process other chemicals. It is, in short, the industry of the "cold box," itself a loose term referring to the section of the plant at which the low temperatures are maintained.

The Two Parts: In fact, the industry is pretty much like entropy: it defies definition. It is nowhere near as unwieldy as entropy, though, when it comes to delineating its function and scope:

The main products of the industry—oxygen, nitrogen, argon and the less important rare gases, krypton, neon and xenon—are produced by air separation. Helium and liquid hydrogen are significant products, too, and liquefied methane has enormous potential. Fluorine is produced cryogenically but is not, properly speaking, an industrial gas.** Cryogenic techniques comparable with those needed to produce those products are also used in purifying hydrogen, methane and other hydrocarbons and in making carbon monoxide for isocyanate manufacture.

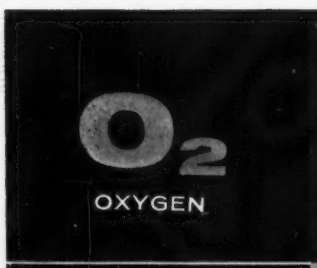
Historically, the industry has been split in two main parts: firms engaged in producing and marketing the products and those that design and engineer cold boxes for various processes. The division is fast disappearing; in particular, the trend has been for the engineering firm to become the operator. However, the old division is still a helpful device for studying the industry.

Among producers, Linde (a division of Union Carbide Corp.) is far and away the dominant factor. The pioneer in air-separation plants in the U.S., it still accounts for approximately 50% of the dollars (excluding equipment). Next is Air Reduction Sales Co., division of Air Reduction, Inc., with about 20%, followed by Air Products & Chemical Corp. and National Cylinder Gas (division of Chemetron), which split 15% between them. Liquid Carbonic (division of General Dynamics Corp.) rounds out the national list of cryogenic-industrial gas producers.

In addition to the big national firms, there are well over 100 regional producers. Some of them are fair-sized operations. One of the largest, Big Three Welding Equipment Co. (Houston, Tex.), for example, has three plants to make liquid oxygen and nitrogen; capacity for the units comes to 110 tons/day. In addition, it

* An unavoidably arbitrary point. Some consider cryogenic temperatures as any degree below —100 F. Some consider cryogenic temperatures as those within a few degrees of absolute zero (— 459.7 F.). There are advocates for several points in between.

** Liquid fluorine is a potent oxidizer for liquid-propellant systems and could be considered the counterpart of liquid hydrogen (fuel). The product, however, is closely identified with Allied Chemical, which is not normally considered part of the industrial gas business.

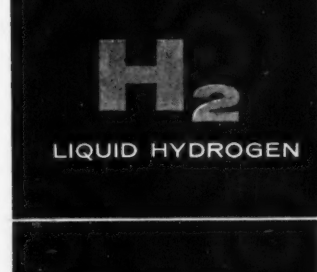


Oxygen use is due to grow from 5.2 million tons in '60 to 8.5 million tons in '65. Most of this gain will come from steel companies, which will double their take to 4 million tons. But CPI consumption will rise 50% in that period, could easily double again before '70 to become the No. 1 oxygen customer – at 6 million tons/year. Use in rockets will increase 10%, all other uses will be 25% higher in '65 than in '60, taking 1 million tons.

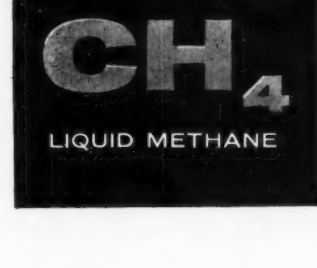
Nitrogen shipments in '60 (excluding that used in ammonia) came to 17.5 billion cu.ft., valued at $27.9 million. Prospects for '70: shipments of 80-90 billion cu.ft. – adding up to a $125-150-million industry. Behind this spree will be use of nitrogen in freezing and storing food; in oil well drilling; a continued surge in rockets and space simulation applications; steady-to-spectacular growths in chemical, metallurgical and other industries.

Argon shipments in '60 – 570 million cu.ft., worth $14.5 million – could easily double over the next 5-10 years. But the industry is plagued with overcapacity problems, due in part to a big buildup for processing titanium and zirconium, a market that never lived up to expectations. Low operating costs (after relatively high plant investment) also have tended to push prices down. Outlook: a continuing steady downward pressure on prices.

Helium use will expand from 522 million cu.ft. in '60 to 860 million cu.ft. by '65 and should top 1.3 billion cu.ft. by '70. The government's conservation program to "stockpile" helium will mean multimillion-dollar expenditures for new plants. It will also mean a higher price to helium customers. Meanwhile, liquid helium is opening brand-new areas of research at temperatures close to absolute zero. Sample applications: cryotrons and cryogyros.



U.S. capacity for liquid hydrogen, now about 53 tons/day, will shortly be more than 79 tons/day. It will likely surpass 100 tons/day before '65. Most of this is going into fuel for rockets. Hopes for liquid hydrogen in nonmilitary markets depend upon its high-purity and the fact that it can be hauled by trailers in large volumes. Its use, however, must be assessed against availability of by-product hydrogen and that produced by captive generation.



Although not now done on a large scale, liquefaction of methane could develop into a billion-dollar industry. There's a tremendous potential for the technique in transporting of natural gas from places like Africa, or from South America to England, Italy or Japan. The method is also being considered as a "peak-shaving" device for utilities firms: they could sell gas during the peak winter months and store it during the summer.

operates a 100-tons/day plant (at Orange, Tex.) to make nitrogen gas.

In volume also, Linde probably accounts for 50% of the total; Air Reduction ranks second. Air Products probably is a strong third due to its large over-the-fence sales, to steel companies in particular. Moreover, it has been building up its position in distributing gas (and liquids, too) by expansion and acquisition. Within the past three months it has taken over Southern Oxygen and Delta Oxygen. It has expanded its over-the-fence sales by building five plants worth $37 million this year.

A number of smaller oxygen producers have banded together in the Independent Oxygen Producers Assn. They represent the lion's share (although not all) of the production of smaller companies. Estimated member capacities: oxygen, 124 million cu.ft./month for gas, 15,000 tons/month for liquid; nitrogen, 130 million cu.ft./month of gas, 8,000 tons/month of liquid; argon, 3.2 million cu.ft./month of gas, 200 tons/month of liquid.

Engineering-Operators: A number of companies have at one time or another shown an interest in cold-box engineering. M. W. Kellogg worked on portable oxygen units shortly after the war. Stacey Bros. and Foster Wheeler have also been active. Blaw-Knox did considerable work in the cryogenic area, at one time had exclusive rights to German Linde's know-how. But it did not want to follow the trend into the operations end of the business. Although it still has an arrangement with German Linde, it's a nonexclusive one and the firm is not nearly so active as it once was.

By and large, however, the important cryogenic engineering firms are these: American Air Liquide, Air Products, American Messer, Dravo Corp., Hydrocarbon Research, Carbide's Linde, Pritchard (*See Dimension, p. 64*). For the most part these firms concentrate on the bigger jobs. Smaller air-separation plants are the domain of firms such as Superior Air Products, (Newark, N.J.) and Independent Engineering (O'Fallon, Ill.), now part of Cryogenics, Inc.

The size division is not clear-cut by any means, though. Air Products has in the past done considerable work in the smaller-plant business, although it has indicated a trend away from small plants. Superior Air Products builds plants ranging from 0.2 tons/day (200 cu.ft./hour) up to 25 tons/day. Independent Engineering extends the range up to 70 tons/day. And Superior has recently acquired rights from the British firm, Petrocarbon Ltd., to a process involving a new nitrogen cycle and expects to bid on jobs up to 100 tons/day of nitrogen. (These units could produce as much as 20 tons/day of oxygen as a coproduct). In the upper end of the range, these companies would be in direct competition with the six firms specializing in bigger plants. Such overlapping, however, is relatively rare in the business.

Trend to Ownership: Not rare at all, however, is the case in which the engineering firm undertakes ownership and operation of the plant. In fact, Air Products, Linde, Hydrocarbon Research and American Messer are now interested to varying degrees in both engineering and operation. Air Reduction, which had been contracting its work out, has recently set up its own cryogenic engineering department.

There are a number of factors contributing to this trend. Steel companies, the biggest customers for oxygen, have been notably reluctant to undertake ownership and operation of air-separation plants. This has led to a large number of over-the-fence (or on-site) units, big plants built primarily to serve a single customer. The geneology of this development is in dispute. Air Products claims to have built the first over-the-fence plant. So do Linde and Air Reduction. Certainly, however, Air Products was the first to enter the field in a big way.

In effect, then, other engineers have had to follow suit, almost to stay in business. There's another angle, too. In a normal year, there are perhaps 10-20 cryogenic on-site jobs available. The total billing for these plants would be $50-60 million. With five to seven companies bidding for each, it does not mean as much business for any one as it would like. The opportunity of owning and operating a plant thus gives it a desired area of diversification.

Partly as an offshoot of this factor the subject of financing is a somewhat touchy one to the industry. For instance, a company operating a large plant supplying a steel customer may have a long-term contract for the oxygen supply. With a proved technology and a guaranteed customer for the output, the firm may have no difficulty getting a 10-year loan at attractive rates from an insurance company or other financial institution. Nobody objects to that; the trouble comes in apportioning the return on investment to the selling price of the product.

One school argues that the operation of an air-separation plant is essentially part of the chemical industry and the return on the whole investment should be commensurate with that obtained in other CPI segments. This, the argument runs, is essential to justify research investments which, in turn, are needed to guarantee the long-range welfare of the whole industry.

On the other hand, the president of a prominent firm

in the field sums up the opposing school this way: "That's a fine theory. But the truth about this business is that it's extremely competitive, and to meet competition, you're just about forced to shave the price to a point where you don't get much of a return on the whole investment. But if you load it with debt, you can still get a fair return on your own share of your own equity."

In any case, the trend to such financing is apparently with the industry to stay. Air Reduction, one of the older, established firms in the business, until recently has been content to stay on the merchant side—relatively low volume but high unit price sales. It has recently made moves to shore up its over-the-fence sales and is using debt financing, at least initially.

Hydrocarbon Research, long identified as an engineering firm, reports that financial details of the plant it is building to supply Tenneco's acetylene plant near Houston, Tex. (*CW, June 24, p. 43*) have not been ironed out, but it is certain that funded debt will play a key role. On the other hand, Linde eschews that type of financing. But Linde freely admits that when it builds an air-separation plant, the equipment is supplied at cost from its fabricating shops—i.e., the shops are operated as budget, rather than profit, centers.

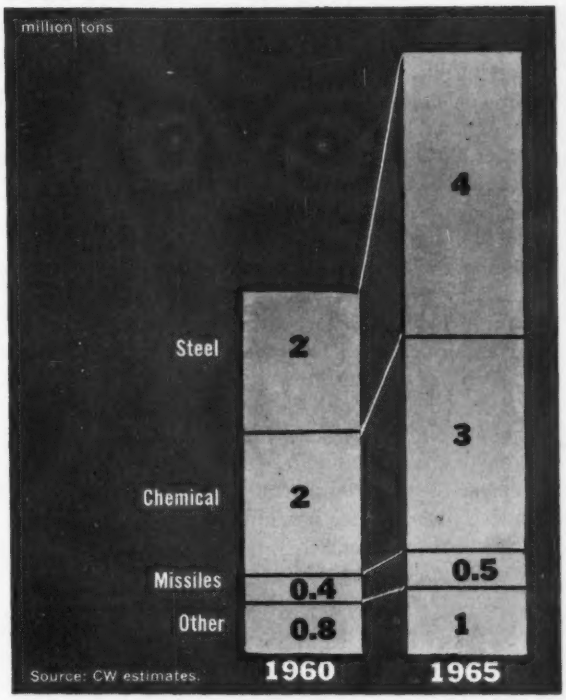
Buy or Make: What this means to chemical (and other) customers for oxygen, nitrogen and other gases, is that they are getting products at prices that would have been unheard of just a few years back. Moreover, they have a wide choice of how they can get them. Basically, there are three ways open to the potential customer—with a number of variations on each:

(1) He can buy the plant on a turnkey basis, operate it himself. This has been the favorite choice in the past for the chemical industry; captive plants supply probably 80% of all the tonnage oxygen consumed in making chemicals. It has also been the choice of the Air Force for most of its liquid oxygen.

(2) He can lease the plant on a long-term (10-15 year) basis. There are several variations on this. For instance, after the end of the lease period, ownership can revert to the customer. Air Products encouraged leasing arrangements, at one time, particularly for small plants (*CW, June 28, '52, p. 34*). But the idea has never really caught on in the chemical industry.

(3) He can buy the product through an on-site arrangement. This has been the preferred method of steel companies and is becoming increasingly popular with the chemical industry. One important reason: the customer does not tie up capital that may well earn more elsewhere. Also, the oxygen supplier will frequently put up a plant larger than necessary to supply the one customer, then "merchant" the extra output. This provides the customer with a certain amount of "backup" and gives the supplier the opportunity to attain large-scale economies in a new location.

U. S. Oxygen Consumption Pattern



Air Products used this ploy to establish itself in the merchant business. Hydrocarbon Research (at Mingo Oxygen, Mingo Junction, O.) makes liquid oxygen—over the needs of Wheeling Steel—and liquid argon, both of which are "wholesaled" to National Cylinder Gas. It's looking for a similar tie-up at Tenneco.

OXYGEN

"In the oxygen business," says a member of the planning department of one of the majors, "20% volume growth is considered a good year, 10-15% normal. A 2-3% growth is something to worry about."

For the next 10 years at least, the industry seems assured of freedom from worry. In '60, total oxygen consumption was probably 5.2 million tons. By '65, it should be 8.5 million tons. Most of this increase will come from steel. After that, steel will probably level off to a more modest growth rate. But the CPI will take up the slack and by '75 should be taking three times as much as it does now.

There are several factors that could upset the time-

table, however, so that individual outlets have to be studied separately.

Oxygen for Steel: Right now, oxygen performs several important functions in a steel mill. But the biggest use is in the conversion of hot pig iron and scrap into steel. This is done in open-hearth furnaces (which account for over 80% of national steel capacity), in LD converters and electric furnaces.

In open-hearth furnaces, iron oxide used to be added with the charge. Its primary function is to oxidize carbon to carbon monoxide and so drive it out of the metal. The gas starts to bubble (the ore boil) and brings the iron oxide into contact with silicon, phosphorus and other impurities. They form oxides and float to the surface as part of the slag.

Limestone added with the charge does a big job, too. At about 1500 F, it calcines to calcium oxide and carbon dioxide (the lime boil). The carbon dioxide reacts with some of the carbon left to form carbon monoxide. And the calcium oxide neutralizes the silica and phosphorous pentoxide, which would otherwise attack the basic refractory lining.

The difficulty with adding iron oxide is that its oxidizing reactions are endothermic, so more heat must be added. When tonnage oxygen became available at reasonable prices, steel makers found they could use it to better advantage. One big reason is that its reactions are exothermic and, instead of having to add heat, producers get a heat bonus. In that way, they're able to step up the output of their open-hearth furnaces by 30% or more.

Air Products and Ford have teamed up in another development that could have an important impact on oxygen-steel practices: the oxy-fuel lance. In this, natural gas (fuel) and oxygen are mixed, introduced through a lance and burned. The oxygen permits quicker heating of scrap and so slashes the time needed to melt-down scrap. Linde and Air Reduction offer oxy-fuel lances, too.

A further heat-conserving gambit for use with the oxy-fuel lance is to add burnt lime (calcium oxide) instead of calcium carbonate.

The LD converter* is a successful attempt to combine the high throughput of a Bessemer converter with the higher quality product of the open hearth. The trouble with normal Bessemer operation is that nitrogen in the air blown up through the bottom causes nitrogen to be entrained in the metal. Simple substitution of oxygen for air is not sufficient because the oxygen damages the refractory lining. The solution: a lined pot, roughly the shape of an outsized milk bottle into which is inserted a water-cooled oxygen lance. The oxygen performs the same function that it does in an open hearth.

In the electric furnace, oxygen can also be employed to drive out carbon or to add heat. It's even possible to take electrodes out and supply all heat through combustion with oxygen. Used primarily for making stainless steel, electric furnaces account for less then 10% of total domestic steel capacity.

How Much They Need: At present, U.S. steel mills probably use about 500-600 cu.ft. of oxygen per ton of steel (one ton of oxygen is equivalent to 24,160 cu.ft.). The potential is bigger. There are no precise figures on how much oxygen can be used, because of variations in mill practice and other factors. In general, though, full utilization of oxygen in an open hearth to drive out carbon and beef up heat would require about 800 cu.ft./ton. It's possible to run this up to 1,400-1,500 cu.ft./ton in so-called superpractice.

In this case, the open hearth is operated essentially as a shallow LD. The oxy-lance in open hearths could also boost oxygen requirements. In "trick heats,"* Ford was able to get outputs of 60-100 tons/hour, which compares favorably with the 85-100 tons/hour from an LD. And National Steel is installing lances with twice the Btu. output of the ones Ford used, indicating a possible 150-tons/hour rate. The oxy-lance is still at an early stage of development, but indications are that used in conjunction with roof lances, it would make the open hearth a customer for 1,800-3,000 cu.ft./ton.

An LD converter uses 1,800-2,000 cu.ft./ton of steel, when the charge is 100% hot metal. Use of up to 25% scrap is feasible and in that case, requirements are only 1,400-1,500 cu.ft./ton. At the beginning of this year, annual U.S. LD converter capacity was 4.2 million tons. At least another 5.1 million tons/year is planned. (In the rest of the world, LD capacity has grown faster than in the U.S. As of the first of this year, installed capacity outside the U.S. was 11.4 million tons with another 22 million tons planned.)

There are many factors that have tended to hold back the growth of LD installations. First, of course, the open hearths are built and there is skilled manpower available to operate them. Also, the high throughputs can actually be a handicap in making alloy steels, where more time is desirable for making additions of alloying ingredients. Scrap-melting ability has also held back growth.

* After the Austrian towns, Linz (site of Vereinigte Osterreichische Eisen-und-Stahlwerke AG) and Donawitz (site of Oesterreichische-Alpine Montangesellschat). The two mills did the practical development work on the process. There are other, similar oxygen lance processes for steel: the Kaldo, a Swedish one using a rotating converter and the Rotor, a German one using a horizontal, cylindrical vessel rotating around its horizontal axis.

* A trick (or hero) heat means that special preparations are taken for an actual production run and practice could not be sustained day-in and day-out.

In any event, the requirements for all other uses for oxygen in the steel industry pale in comparison with its potential in the blast furnace. Some oxygen is now used to enrich the blast. Oxygen enrichment is employed in making ferromanganese (which requires higher temperatures) to save fuel and time. At the moment, it isn't possible to generalize on the economics of oxygen in the blast furnace; each mill must be studied separately. However, it seems clear that if demand for steel (and therefore pig iron) should climb sharply, the industry would turn to oxygen in conjunction with natural gas or oil as a means of boosting pig iron production (*CW, July 8, p. 63*). This would be the alternative to putting in more blast furnace capacity.

There are no solid data now to place a limit on the amount of oxygen that could be used in blast furnaces. But enrichments as high as 35% oxygen appear feasible. That would mean ½ ton of oxygen for every ton of pig iron.

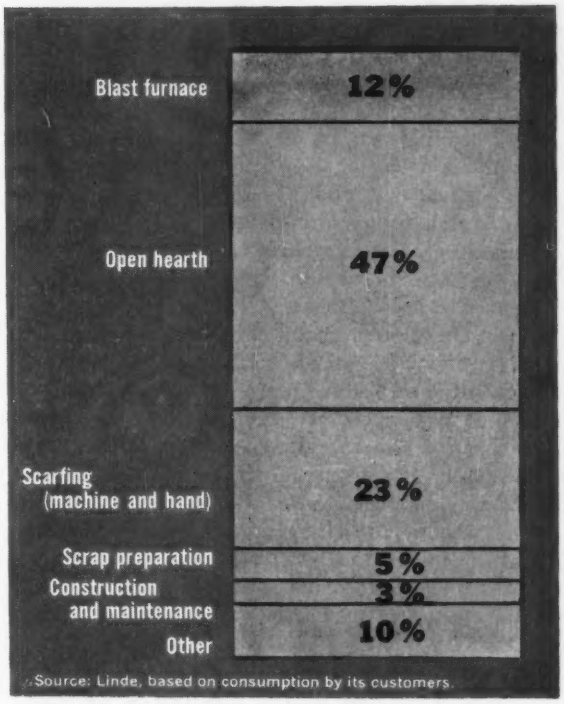
Adding Up: If steel demand should be at 110-120 million tons in '65, then demand for oxygen would hit 4 million tons. But if steel demand should skyrocket to 150-160 million tons, oxygen demand could easily hit 10 million tons. In that rather unlikely event, another 4 million tons of oxygen for the blast furnace would be needed; and steel usage would account for 2 million tons more.

Nobody in the oxygen industry is banking on such a demand, however. A total demand for oxygen of 4 million tons is a more reasonable outlook. At that point, oxygen growth would settle down to a modest rate, approximating that of steel itself.

Oxygen for Chemicals: No such barrier exists for oxygen in the chemical process industry, however. Partial oxidation processes for natural gas now take the lion's share of the oxygen used in chemical processing (*see chart, p. 63*). For instance, it takes 5-5.5 lbs. of oxygen to make 1 lb. of acetylene via the Sachse process. In January of last year, approximately 880,000 tons of oxygen capacity was installed for acetylene plants. Another 328,000 tons has since been installed or planned.

Ranking behind acetylene as an oxygen consumer is synthesis gas for ammonia and methanol. As of the first of '60, this accounted for 839,600 tons of installed oxygen capacity. This is not likely to grow in ammonia plants, however. Thanks largely to Chemical Construction Corp., steam reformation has been developed to a point where partial oxidation does not always compete when natural gas is the starting material. When coal or oil is used, the balance changes. And in synthesis gas for making methanol, partial oxidation produces a more favorable ratio of hydrogen to carbon monoxide. Du Pont will employ on-site oxygen (from Air Reduction) in its new methanol plant in Huron, O. What's more, it is always possible that if natural gas prices should continue to rise, partial oxidation may become more competitive for ammonia-making also.

U. S. Oxygen Usage in Steel Mills, '60



Ethylene oxide is a substantial and growing customer for oxygen. Installed oxide capacity the first of last year, 127,800 annual tons, is being doubled to 256,270 tons. A wide variety of other uses account for the remaining chemical oxygen—LPG oxidation, production of acrolein, hydrogen peroxide, and others. The growth potential for these collectively is considerable. In Jan., '60, 237,850 tons were installed to serve them. This will shortly be 563,870 tons.

While existing uses of oxygen by the chemical industry are growing, the real spurt will have to come from brand new uses. Indications of the type of operation to expect can be found in manufacture of titanium dioxide, acetaldehyde and phthalic anhydride. In Du Pont's new titanium dioxide process, the titanium tetrachloride is oxidized with oxygen or oxygen-enriched air. Others, it is believed, are interested in using the same process or variations of it (*CW, Sept. 9, p. 89*).

In the new Wacker process for making acetaldehyde,

ethylene is oxidized directly. There are two versions of this, one using air, the other using oxygen. Celanese, the first firm to use the process in the U.S., has not said which one it will use. But the approach does point up the possibilities for oxygen in production of established products.

And investigations are under way on the use of oxygen enrichment in the air-oxidation of naphthalene to make phthalic anhydride. The theory is that oxygen would permit higher throughputs. However, it would also mean higher heat evolution and the idea will likely be confined to fluidized-bed plants, where heat control is simpler, at least in theory.

There are, all told, some 1,000 commercial air oxidations (including operations such as regeneration of catalysts). All of them could benefit from oxygen substitution or enrichment. The problem is whether the benefits can offset the cost of added oxygen. In carbon black, for instance, use of oxygen permits production of a measurably different product. But nobody is yet quite certain whether the change is worthwhile. Similarly, oxygen might be attractive in making sulfuric and nitric acid. Although the economics are not clear, the feeling is that the use of oxygen has more merit in sulfuric manufacture.

In cement and copper, a better case can be made right now. Linde has worked with one of the major cement-processing companies, and the results so far indicate it's possible to boost capacity 30%. Adoption of oxygen, of course, depends on the need for cement in various areas of the country. It will probably not be too attractive in the East where there is already abundant cement capacity, or in places like the Rocky Mountain area where demand is not apt to grow significantly. In the South and Midwest, the story is different. Over-all, it seems probable that the cement industry will be using 1 million tons/year inside a decade if the idea takes hold.

Phelps Dodge and Kennecott are working with oxygen in copper refining (*CW, Oct. 8, '60, p. 72*). Oxygen people are bullish on this, feel that the impact of oxygen on copper will be similar to its impact on steel. The possibility is that 1,400 cu.ft. of oxygen could be employed to make a ton of copper. At 1-million-tons/-year copper production, that comes to an annual oxygen market of 580,000 tons.

Considerable interest has been shown in other nonferrous processing such as lead and zinc. One lead producer, for example, has operated a lead blast furnace with oxygen enrichment. Results in these fields have not been as encouraging as they have been in copper, however.

Pulping and Gasification: There's a big potential for oxygen in treating wastes in the pulp and paper industry to recover sulfur values. The problems there are not strictly economic, of course, because of increasingly tight legislation on stream pollution. In one Southern mill, liquid oxygen is purchased to burn wastes during the two dry months. There is no problem about dumping into the stream during the 10 other months.

Gasification of coal on a large scale would provide an enormous outlet for oxygen. In Great Britain, three divisions of the national gas industry have built three gasification plants—two based on coal (via the Lurgi process) and one based on oil. The three use 700 tons of oxygen/day to make 100 million cu.ft. of town gas. The total gas market in Britain is 16 times that big, so that if all the gas were made that way, gasification there would need 3.5 million tons/year. Even under the most favorable conditions, however, it would take decades to approach that potential. And in the U.S., where gas and oil are still plentiful, large-scale gasification seems something for the remote future.

The big picture for the use of oxygen in the CPI then is this: Increased use in existing applications and gradual exploitation of new areas will assure oxygen a hefty increase for the next five years, so that use in '65 should hit 3 million tons. After that growth should start spiraling upward as new ideas catch on, and consumption could well double in five years—to 6 million tons by '70.

Small but Growing: In the meantime, other uses will not stand still. The biggest customer after steel and chemicals is the rocket and missile field, primarily because of the use of liquid oxygen as oxidizer in liquid propellants. It's hard to pin down an exact total at this time, but it probably comes to 400,000 tons/year. The rapidly changing technology makes it impossible to chart the future with any degree of precision. But a 25% growth to 500,000 tons/year by '65 seems a reasonably safe assumption.

A number of small uses are also growing, although individually they have but small impact on the total. In the medical field, for instance, oxygen, which at one time was a last-resort measure, is now routine therapy in a number of cases. All new general hospitals are being built with centralized oxygen distribution systems. From '55 to '60, use of medical oxygen doubled. By '65, it should be triple what it is now.

The total miscellaneous uses for oxygen in '60 took about 800,000 tons. It's likely to grow 25% by '65 to 1 million tons.

What Price Oxygen: Oxygen producers shy away from generalizations about oxygen costs and selling

prices. There are sound reasons for this. There are entirely too many variables. For instance, much depends on the processing cycle that's employed. There are at least five basic cycles and each has a number of variations. The principle involved is the same, of course. Air is liquefied and then fractionated into its components. But different designs are required, depending on whether oxygen, nitrogen or both are desired, the purity required, whether some or all of the product is desired as a liquid and, if as a gas, at what pressure.

The two big producing companies, Air Products and Linde, which design their own plants, have opposite theories on cycles. Air Products employs a split cycle. By a special pump, it moves liquid from the column, keeps some as a liquid for shipment or storage, allows the rest to vaporize to the needed pressure.

Linde favors a low-pressure cycle. The oxygen is allowed to vaporize and expand almost to atmospheric pressure. It is then recompressed to the pressure desired.

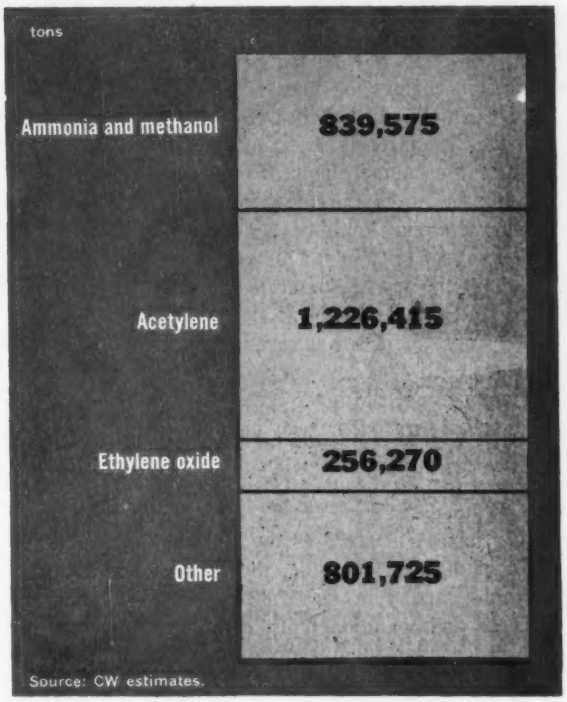
Hydrocarbon Research is planted firmly in Linde's corner favoring the low-pressure approach. Others, like Air Liquide and American Messer, say it all depends on the application. They'll study the requirements and then use the cycle they feel is most suited for the job.

Both schools can muster strong arguments to support their points of view. Low-pressure proponents say their cycle is far and away the most economical in terms of power, which bulks big in oxygen costs. The product is normally 95% oxygen but with minor modifications, high-purity (99.5%) oxygen can be produced. Air Products contends, on the other hand, that its plant allows for more flexibility in making either liquid or gas. Others, however, also point out that it's feasible to make a certain amount of liquid—up to 5%—in a low-pressure plant.

Both schools also argue that their cycle is the safest. And actually, they're both right. The safest, most economical route for each is the one with which it has had the most experience. And in any case variables in the location of the plant and customer's needs will have a greater effect on prices than the designer's choice of cycle.

For instance, the pressure at which the product is needed can alter costs drastically: It costs $1.25/ton (counting operating costs, return on investment and other factors) to compress oxygen from 25 psi. to 200 psi. Power costs are important, too, accounting for, as a rule, more than 20% of the total oxygen costs and just about as much as capital costs in oxygen production. In the low-pressure cycle, it takes 400 kwh. to make a ton of oxygen compressed to an average figure; 290 kwh. of this are for separation, the rest for compression. At electric costs of 8 mils/kwh., that's $3.20/ton. On the other hand, if power costs only 4 mils/kwh., the figure drops to $1.60/ton.

Oxygen Capacity for Chemicals, '62



If high-purity nitrogen is desired as a coproduct, capital costs are about 10% higher, because of the need to change columns, heat exchangers, in addition to higher power costs (because of the slight pressure drop through the extra equipment). Also, the price is higher if the customer needs a backup supply. The rule in industry is a 355-day, round-the-clock operation. Linde, for example, figures on operating 97% of the time. One-half the down-time is scheduled, half is not. A customer can get a guarantee of supply 100% of the time, but he'll pay extra for it.

Finally, of course, the size of the plant can make a big difference in the cost of the product. Independent Engineering, for example, sells a 1-ton/day oxygen package unit for $30,000-35,000. And to that must be added the cost of installation (which is fairly simple). Cost per ton drops as capacity goes up.

There's no firm definition for "tonnage oxygen." But the term usually refers to plants of 150-200 tons/day and up. Costs for such plants run $10,000-12,000/-

DIMENSION

Who's who in cryogenic engineering and what they offer

Air Products & Chemicals (Allentown, Pa.) started out as an engineering firm, is now an important producer as well. Its activities cover the whole range of cryogenic engineering. It engineered the cold box portions of two helium plants. It built (now operates) the two big Air Force liquid hydrogen plants in West Palm Beach, and five liquid-oxygen plants for Air Force, which supply 85% of the service needs. It engineered and built the low-temperature unit for Universal Cyclops In-Fab room, a facility maintained under an argon atmosphere for fabricating refractory metals.

It installed two low-temperature purification units for methane used to make chlorinated products. It has built several nitrogen wash units to purify hydrogen for ammonia production.

American Air Liquide (New York City) performs several functions for France's L'Aire Liquide. One of its big jobs is to serve as the engineering sales office for Canadian Air Liquide, the operating arm of the French company in the U.S. The company has engineered air-separation units, carbon monoxide plants (for isocyanate manufacture), methane purification units, and nitrogen wash facilities.

With the French parent, one of the biggest cryogenic firms in the world, it is making a study of liquefied methane. It has no liquid hydrogen experience in this country, but the parent built a liquid hydrogen plant (for deuterium production through fractionation).

American Messer (New York City) is an affiliate of Adolf Messer, GmbH., the highly respected German supplier of low-temperature equipment. However, the firm does not necessarily use German equipment in its designs. Like most of the other companies, it offers a complete line of low-temperature processes and plants. One of its unusual jobs was the argon production plant for Spencer (*CW, Aug. 22, '59, p. 59*).

Messer will soon be in the operating end of the air-separation business. It's building a plant at Tewskbury, Mass., to make 100 tons/day of oxygen, nitrogen, and argon. The product will go to Liquid Carbonic, which will distribute it in the area, mainly to electronic customers. One principal reason for owning and operating the plant is to obtain a facility for research and testing. The company expects to do more owning-operating in the future.

Hydrocarbon Research (New York City) is a storehouse of cryogenic know-how, has a number of claims to fame. It built the first big tonnage oxygen plants for chemical process use (for Carthage Hydrocol) and a big (600 tons/day) one for Monsanto. With Texaco, it developed the partial oxidation process.

It has worked in helium, although it has built no plants. It engineered a liquid hydrogen plant for the Air Force and had completed 90% of the construction before changing requirements moved the Air Force to abandon the project in favor of bigger ones.

It is also one of the few companies in the world to engineer a methane liquefaction plant: In '47, it designed a 4.5-million-cu.ft./day liquefaction unit to be located near Moscow. Little is known about the project now but reports are that it is still operating and that liquid methane is carried around Moscow by trucks in routine deliveries.

HRI now owns and operates (with Wheeling Steel) Mingo Oxygen, will own and operate a plant for Tenneco (*opposite page*).

Dravo Corp., (Pittsburgh, Pa.), a relative newcomer to the field, has an agreement with Carbide's Linde. It is building two plants now, one for Ford, the other for National Cylinder Gas (which will own and operate it as an on-site unit to supply Sharon Steel). At least for the moment, it will not discuss any cryogenic interests beyond air separation.

Linde (*division of Union Carbide Corp.*) has built one U.S. plant for sale, an oxygen unit for Olin Mathieson at Brandenburg, Ky. Competitors say that Linde will build a plant only "when forced into it." Linde says the same thing in a different way: "We prefer to operate the plant and sell the product. Usually, when a customer makes a full study, he will agree with us. That doesn't mean we're not anxious to build for other people. It simply means that the customer must make the decision."

J. F. Pritchard & Co. (Kansas City, Mo.) has been in the cryogenic field for over 20 years, dating back to its work on portable liquid oxygen units for the government during World War II. It has built several air-separation plants, although it has let contracts for the cold box portion to others. It is eagerly seeking work in helium extraction plants where it would be prepared to do the whole job. Its major cryogenic effort has been in liquid methane. It owns 50% of Constock-Pritchard, which liquefied the material carried by the ship, *Methane Pioneer.*

ton of installed daily capacity. For a 500-tons/day plant, it drops to $7,000-9,000/ton and at 1,000-tons/-day level to $4,000-6,000/ton.

The price that a customer pays for over-the-fence oxygen varies in proportion. In broad terms, the price range for an average plant will run $8-12/ton, although any of the factors could change that. In small, high-purity plants, the price could be twice that. And in the plant that HRI is building to supply Tenneco, it may well be half that much. The schedule is based on a sliding scale, depending on how much Tenneco takes. But the feeling in industry is that at high usage, Tenneco may well be paying less than $5/ton.

HRI explains the low cost with three factors:

(1) It's the largest single plant built to serve one customer. The size has never been pinpointed but it's believed to be 750 tons/day. Larger plants have been built in multiple units and possibly larger single plants to serve more than one user. But as HRI sees it, the new unit will maximize economies of big production and a single use.

Because of HRI's desire to "wholesale" liquid product, there is a belief that the price to Tenneco will slide with the amount of liquids it is able to wholesale. HRI, however, emphatically denies this. By the same token, the possibility of higher unit-value liquid sales may have been rolled into the price that Tenneco will pay and so help over-all economy. (Building an on-site plant with extra capacity is not unique to HRI by any means, however.)

(2) It's a low-purity (95-98%) plant. This is not unusual for the chemical industry, but steel companies demand high-purity oxygen, so many on-site plants are built to make the higher-purity and somewhat more expensive product.

(3) Fuel costs will be relatively cheap. The plant will employ natural gas to drive the turbines, and HRI points out that gas costs in the area run 20-22¢/million Btus. Gas supplies, it says, have not been firmly nailed down. But there's small doubt that the customer will provide the gas.

Mixed Feelings: The whole operation is being viewed with mixed emotions by the rest of the industry. On the one hand, some feel that the low price to Tenneco is merely indicative of the profit-squeeze the whole industry is facing. On the other, some hope that the possibility of getting oxygen at $5/ton or less may encourage other companies to take a second look at operations that might use oxygen.

The Tenneco-HRI arrangement is a special case. But one industry man sees liquid oxygen prices dropping 20% in the next 5-10 years.

NITROGEN

According to one close industry observer, nitrogen has been enjoying a "quiet boom for some time." Indications are the quiet boom will become a roar.

The U.S. Dept. of Commerce, which tabulates high-purity nitrogen production exclusive of that used in ammonia or ammonia derivatives, reports* 18,566 million cu.ft. were made. This is the equivalent of 674,000 tons. Shipments, including interplant transfers, were somewhat lower—17,460 million cu.ft. (634,000 tons). Bulk of this was shipped as a gas, 9,559 million cu.ft. (348,000 tons). The remaining 7,901 million cu.ft. of gaseous equivalent (286,000 tons) moved as liquid.

To that must be added the amount of nitrogen used in making ammonia. This is a difficult figure to pin down, however, because not all the nitrogen used is made cryogenically. Moreover, some nitrogen used in ammonia plants does not show up in the finished product: When a partial oxidation process is employed to make the synthesis gas, an air-separation plant provides oxygen for the initial oxidation. It also provides nitrogen, which is used to purify the hydrogen (the nitrogen wash) and for the final synthesis of ammonia from hydrogen and nitrogen. The rule of thumb: for each pound of nitrogen used in the final synthesis, ⅓ lb. is used in the nitrogen wash. A nitrogen wash is also employed in separating hydrogen for ammonia from coke oven gas and in purifying hydrogen by-product streams from reformers and other operations.

So adding in the nitrogen used for ammonia, the market for nitrogen produced in air-separation plants is probably three times as big as the government figures indicate. The use of cryogenic nitrogen in ammonia, however, will not grow as fast as it has in the past due to diminishing importance of partial oxidation.

Going Up: The other uses are growing fast. Now, the market for nitrogen is large and diversified (*see chart, p. 68*). All uses are destined for growth of varying degrees. But nitrogen is due for a big play in uses that are now insignificant. Two of the brightest hopes in this regard are in food freezing and storage, and in oil well drilling.

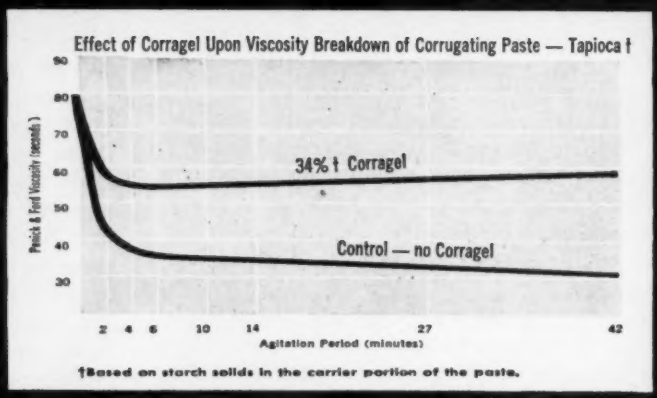
Nitrogen Refrigeration: The possibilities for nitrogen refrigeration of foods is exciting the whole industry. Companies like Linde and Air Reduction are doing considerable development work. National Cylinder Gas recently has established a special task force to study technical and economic aspects of the refrigeration question. Food companies are working diligently on the problem too.

The reasons for all the notice are nitrogen's low boil-

* In Current Industrial Reports Series M28A (60)-13 Supplement 2.

NEWS BRIEFS

ON THE CREATIVE USE OF



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Minerals & Chemicals Philipp

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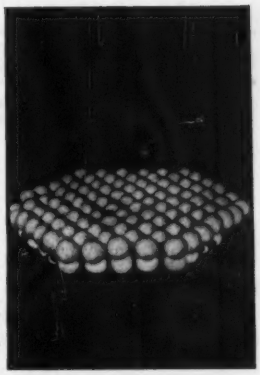
Activated Bauxite

mineral horse with a chemical collar



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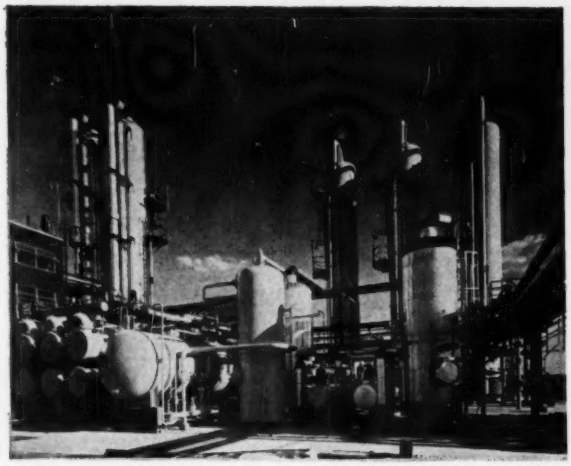

Limestone Products

of premium quality find many uses

Basically, limestone is Calcium Carbonate in the form of the mineral calcite, but various impurities found in it, and grades of each variety, determine the many products for which it may be applied.

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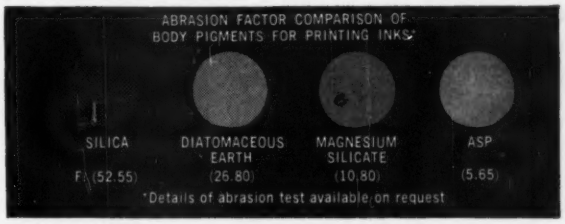

Printing Inks

are improved with aluminum silicate pigments

Inorganic or mineral-based body pigments are preferred for printing inks. Common drawback of most such pigments is their grit content which demands prolonged, heat-generating grinding which adversely affects ink properties in many ways.

Low-abrasion MCP aluminum silicate pigments (ASP's) permit high printing ink grinding speeds, therefore less grinding time, and impart softness and finish to the ink. Unmodified, they are ideal for silk screen and similar inks requiring good viscosity. Newer, surface modified ASP's are best for gravure, flexographic, lithographic, and other inks requiring good flow and length. Benefits are many, including excellent printing quality, low price. For more information, use the coupon.

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ing point (—320 F) and its high heat of vaporization (85.67 Btu./lb.) Also, it sops up an equivalent amount of heat going from its boiling point to about 0 F. And in going from liquid to gas, it expands over 600 times, giving instant cooling to all parts of the enclosure.

These properties are being put to work by Linde in its system, called Polarstream. The idea is simply to store liquid nitrogen aboard a truck or railroad car transporting frozen foods. When the temperature falls to a predetermined level, a thermostat releases a stream of nitrogen. The cooling is almost instantaneous and penetrating. Air Reduction expects to bring out a similar system by the first half of next year.

Linde makes a strong case for the system: It can insure a low temperature more efficiently than mechanical devices can. The unit, being smaller than a mechanical freezer, permits more payload. And since there is no need to worry about air circulation, bigger volumes can be loaded and loading problems are simplified.

The system is being tried in 16 refrigerated, multi-stop vans by Howell Trucking (Secaucus, N.J.). With units leased from Linde, the company has found nitrogen cooling costs to be $9-10/day. This is $2-3/day more than the costs for mechanical refrigeration. But the firm feels it has an over-all saving because of lower spoilage loss and fewer maintenance problems.

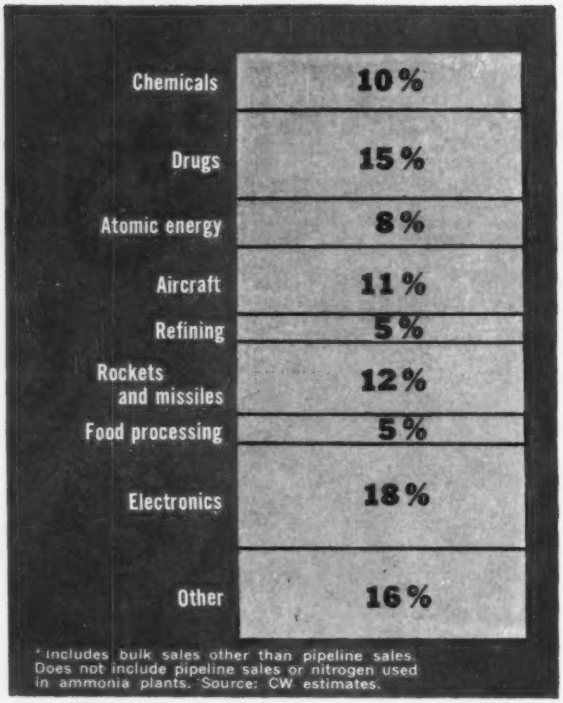
Linde is touting the system for cross-country hauling, too. Trucks have been able to travel coast to coast with two stops for refilling nitrogen. Trucks using ice for cooling have to refill twice a day; with mechanical refrigeration, frequent inspection stops are necessary.

REA Leasing Corp. and Linde are cooperating to make units available for piggyback shipments. The first operational equipment has been leased to Burlington Railroad (a member of the national trailer and container pool operated by REA Leasing), which is using it to piggyback fresh meat for Armour and other packers from Omaha to Chicago and then, through connecting service, to the East Coast. The units are designed to maintain a constant 35 F temperature.

Linde, in fact, is looking at the whole field of perishable and frozen foods. In '59, 67 billion lbs. of the former were sold and 8 billion lbs. of the latter. Hauling them around required 115,000 railroad cars, 40,000 trailers and 200,000 trucks for short- and long-distance carrying. In all, it sees a market for nitrogen of 1 billion cu.ft./year by '65. Actually, the ultimate potential is bigger by 2-4 orders of magnitude.

Other people agree with Linde on the promise, disagree on the approach. Willard Morrison (*see Dimension, p. 83*), for instance, developed a scheme for using liquid nitrogen to freeze the water of composition in food, then to rely on the ice and insulation to maintain the temperature. In a test shipment from Stockton, Calif., through the Panama Canal to Puerto Rico and then to New York, a mixed load of typical frozen food packs arrived at —34 F. The trip took six weeks.

Bulk* Nitrogen Demand Pattern, '60



* Includes bulk sales other than pipeline sales. Does not include pipeline sales or nitrogen used in ammonia plants. Source: CW estimates.

Morrison's idea is that contact between the food and liquid nitrogen takes maximum advantage of the heat of vaporization. In experiments with freight cars, liquid nitrogen feeds in at the top, bathes the food package.

Morrison has assigned his patents in this area to William Prince (Union Stockyards) who has sold them to Isbrandtsen (a shipping concern that has interest in the Liquefreeze Corp.). Liquefreeze Corp. now ships nitrogen-frozen food to Bermuda.

The system, Morrison feels, will turn out to be the most practical method of shipping in less than carload lots, because of elimination of need for space, weight or machinery of any kind. For larger shipments, he has invented a reliquefier. This would be installed at the loading station, recover the cold gas, reliquefy it and re-use it. He reports that two large firms are installing units for refrigeration of ice cream; another national firm will use one for moving pastry.

Because of the re-use of nitrogen, Morrison's idea

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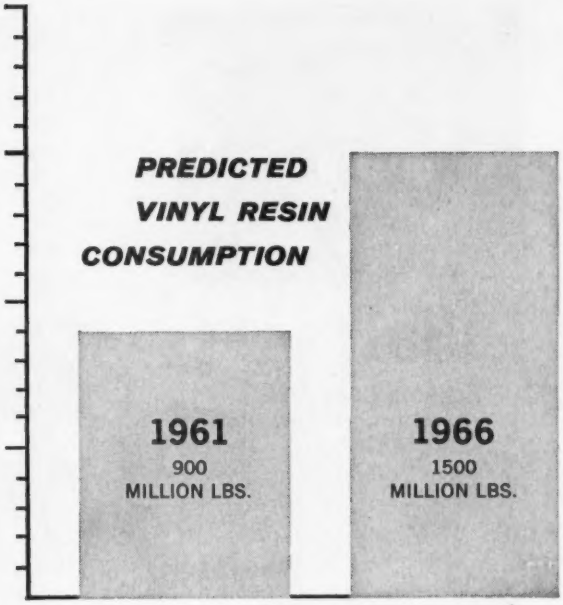

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Monsanto makes more plasticizers than anybody else (*more than 80!*)—including such outstanding performers as *Santicizer*® 409 polymeric plasticizer for permanence; *Santicizer* 160 for stain-safe floor tile; and *Santicizer* 141 for fire retardance, nontoxicity, fast processing, and weatherability. As more-demanding performance requirements arise, Monsanto researchers develop new plasticizers to meet new challenges.

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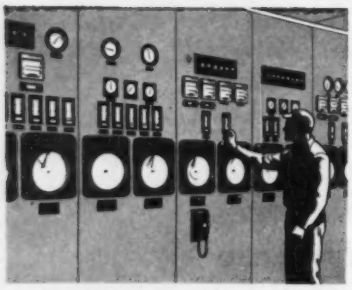
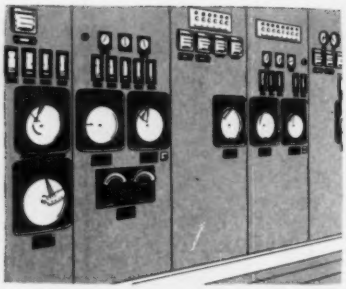


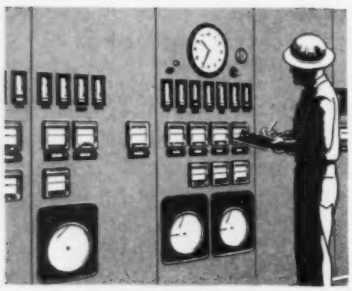
1951

Foxboro Consotrols
selected for new Celanese plant in Pampa, Texas



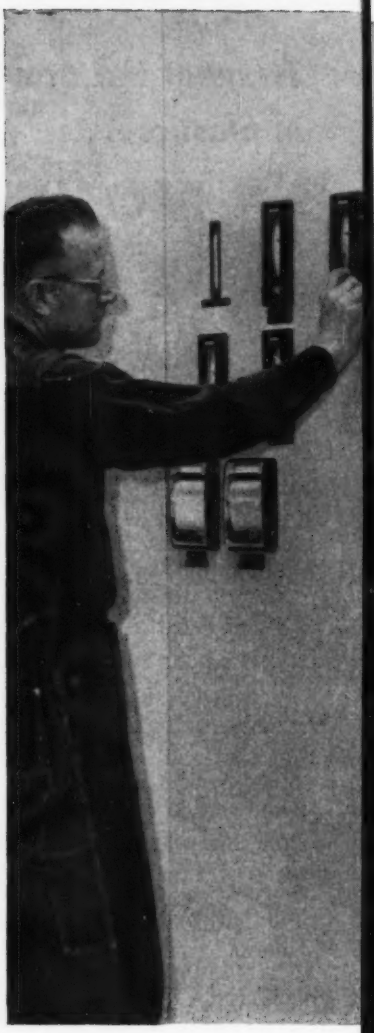
1952

Foxboro Consotrols
selected for new Celanese special products and vinyl acetate units at Pampa

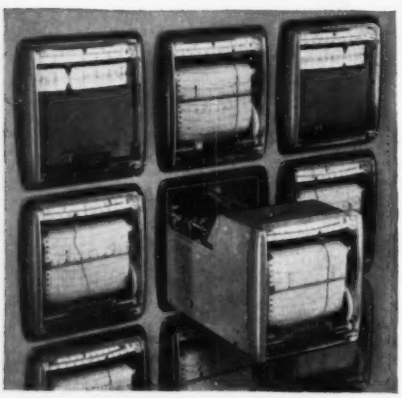


1957

Foxboro Consotrols
selected for new Celanese acrylate unit at Pampa.



. . . and now Foxboro Consotrols* major new



Foxboro M/54-58 Consotrol Recorder-Controllers feature full-scale 4-inch vertical-travel chart; ready adaptability to changes in processing requirements. Instruments mount on 7-inch centers for minimum panel size. Unique "floating disc" M/58 Controller has unmatched stability, sensitivity, and reliability.

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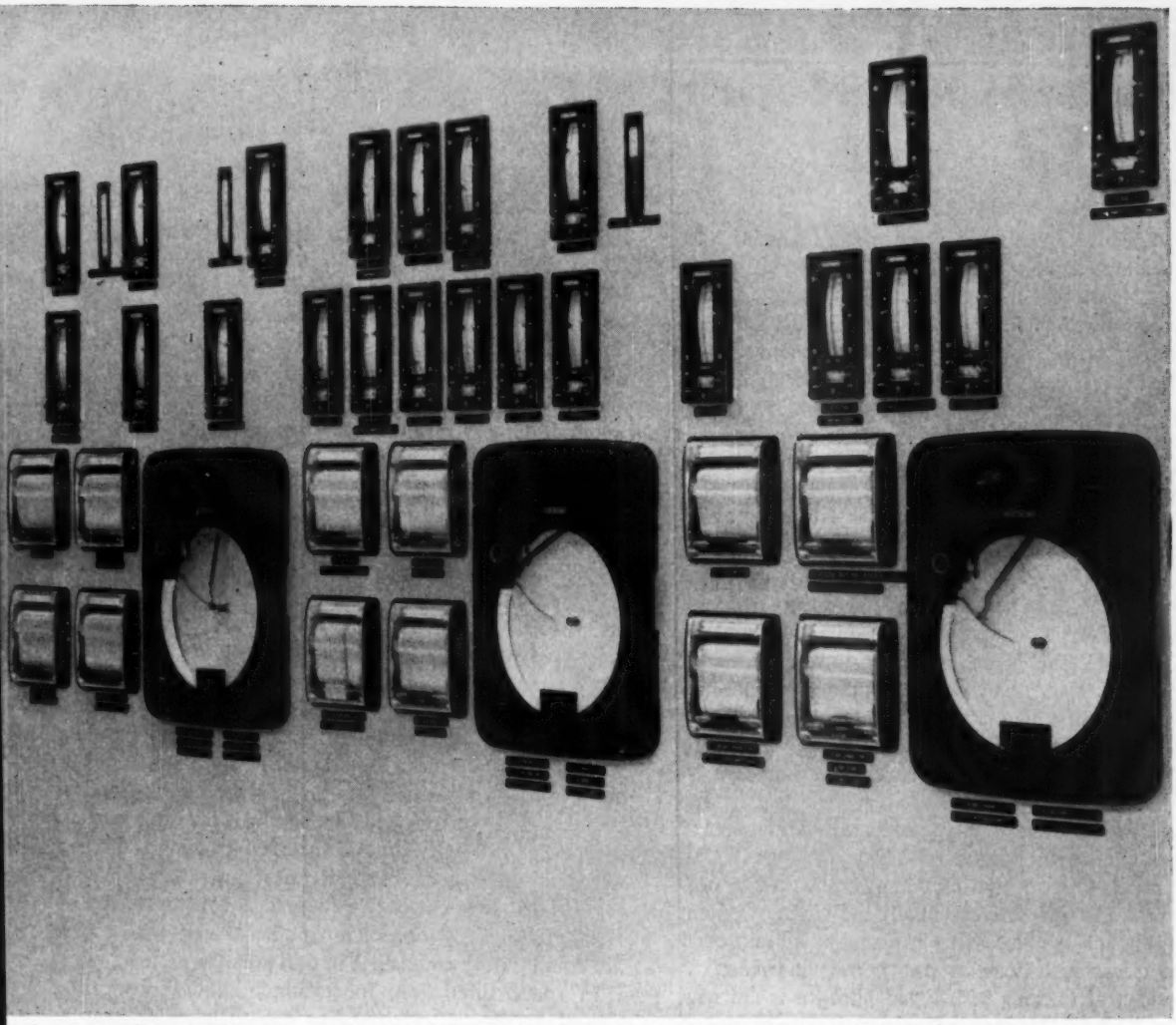

Newest Foxboro Panel, designed and built by Foxboro for Celanese Chemical's Pampa, Texas plant, controls processing in new Higher Acrylates Unit. Foxboro flow, temperature, and pressure transmitters are also used exclusively.

are selected again for Celanese expansion at Pampa!

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would effectively cut total nitrogen sales, should it be widely adopted. And he feels he's in a strong patent position. However, Independent Engineering, for one, has a line of reliquefiers, sees a bright future for them in food. It professes no concern about patents. Morrison's, it says, deal more with the specific application than with the equipment.

The initial freezing of foods with liquid nitrogen is another attractive idea and a big potential for nitrogen. Linde has developed a process, expects to field test it soon. Air Reduction has done a great deal of work, referring to the technique as immersion freezing (which is not necessarily dependent on liquid nitrogen). The method for the most part is aimed at products that cannot be satisfactorily frozen by other methods. Air Reduction, for instance, dips citrus fruits in liquid nitrogen, freezing them solid. It then crushes the fruit to produce individual citrus cells that can be shipped in the frozen state. They could find work as flavoring agents for items such as confectionary products, cottage cheese.

Immersion freezing has been tried on tomatoes and bananas and reportedly yields products that retain many of the qualities of the fresh variety. It's possible to freeze an ear of corn that can then be shucked to produce whole kernels with essentially the vitamin content of the original. It's also being groomed as an improved way to freeze such items as strawberries and meat.

The idea of freezing with liquid nitrogen is not new by any means. Reportedly, Clarence Birdseye tried it almost 35 years ago but abandoned it because of costs. With the combination of cheaper nitrogen and greatly improved insulation, it's becoming more practical. The manager of marketing for one major company says, "If all the frozen food now marketed should use nitrogen at one point in the processing, the market would be measured in trillions of cubic feet."

There are other nonfood possibilities for nitrogen freezing, too. It's now used in cryobiology (mostly to freeze bull semen) to the tune of about 6 tons/day. The potential in animal husbandry for cattle, swine and poultry is probably 60 tons/day. And there are still untapped potentials in freezing and storing whole blood, human tissue and bone marrow.

Nitrogen and Oil: A market comparable to that in food refrigeration is promising to develop in oil-well drilling. Two Houston firms, Nitrogen Engineering Service Co. (NESCO) and Nitrogen Oil Well Service Co. (NOWSCO) have been pushing the idea. (NOWSCO started as a division of Big Three Welding, now operates as a separate company run by the president of Big Three). There's evidence that other oil-well servicers are in the field and are about to make a splurge.

Almost all the major oil companies and many others have tried nitrogen in drilling in a number of different ways. It's being used as a displacement agent in swabbing, as an aid in perforating, as an additive to drilling muds, and as a means of forcing acids or corrosion inhibitors to a predetermined level. The nitrogen is hauled to the well as a liquid—NOWSCO now has eight 2,000 gal. trucks in operation, expects to have 32 within the next few months.

It's difficult to gauge the size of the market that would accrue to nitrogen from use in oil wells. Says a sales manager for one of the nitrogen companies: "Despite the work that has been done, it's still early enough in the game that it could get killed by improper use. So everyone wants to go slowly, making sure it gets done right and doesn't get a bad name."

The need is for very high gas flows for short periods, thirty minutes or so. It would be reasonable to expect 1,000 well treatments a month if the technique catches hold. That would mean a market of 800 million cu.ft./-year, for the foreseeable future. As is the case in food, however, the potential may well be several times that.

Rockets and Missiles: Another fast-growing use for nitrogen is in the rocket and aircraft industry. One seller reports that four out of five requests for nitrogen, representing 90% of the dollar volume of new business, are coming from companies in that area.

In space simulation, for example, liquid nitrogen acts as a "shroud" surrounding the chamber to keep the room cold. (The rooms are maintained under vacuum also, to simulate space. This is another outlet for cryogenic gas. The vacuum is maintained by cryopumping, i.e., a plate maintained at liquid helium temperatures—cryoplate—on the interior walls serves as a cold trap to condense gases.) Some space simulators now take 5-10 million cu.ft./month of nitrogen. In six months, bigger models will be taking 50-60 million cu.ft./month. Within a decade, this use alone could account for the equivalent of 1 billion cu.ft./month of gas.

The rocket industry uses considerable quantities of nitrogen, about 150 tons/day, to transfer propellants. A comparable amount is used to test parts that will be in contact with liquid oxygen. In addition, nitrogen is used as a purge for missile components, to quick-cool wind tunnels, as an inert atmosphere for shock-absorption chambers of hydraulic landing gear.

All Growing: It's pretty hard to find an application for nitrogen that is not destined for growth. In metallurgical applications, bright annealing with nitrogen is on the rise. One company, working with certain grades of aluminum, finds it can improve ductility and tensile

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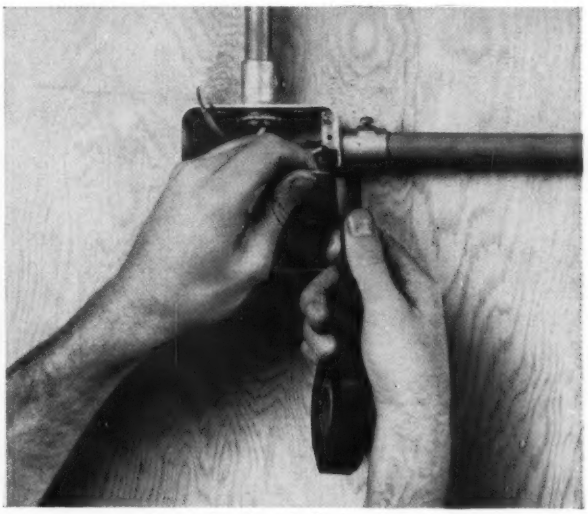

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strength by heating then quenching with liquid nitrogen. Arde-Portland (Paramus, N.J.) has developed a stretching process utilizing liquid nitrogen to improve strength-to-weight ratios of metals (*CW, Sept. 2, p. 57*).

As a blanketing agent, it is increasingly popular. In electronics, it's being employed in the production of transistors and diodes and the materials from which they're made. A fairly new wrinkle: nitrogen is used as the inert carrier for "doping" germanium crystals (i.e., deliberately introducing impurities to produce a positive or negative charge). The chemical industry has always been one of its own best customers for nitrogen, to protect purity or to shield hazardous operations. In making polypropylene, for example, it appears that 10 million lbs. of product requires 1 million cu.ft. of nitrogen. A 500-million-lbs./year market for the plastic then would mean a not-inconsequential demand of 50 million cu.ft. of nitrogen. In addition, nitrogen is employed in the manufacture of Ziegler catalysts.

The food industry is using more, too, in applications not involving refrigeration, in aerosol cans, as a fluffing or sparging agent, as a protective atmosphere in packaging and elsewhere. And it's gaining popularity in wine production.

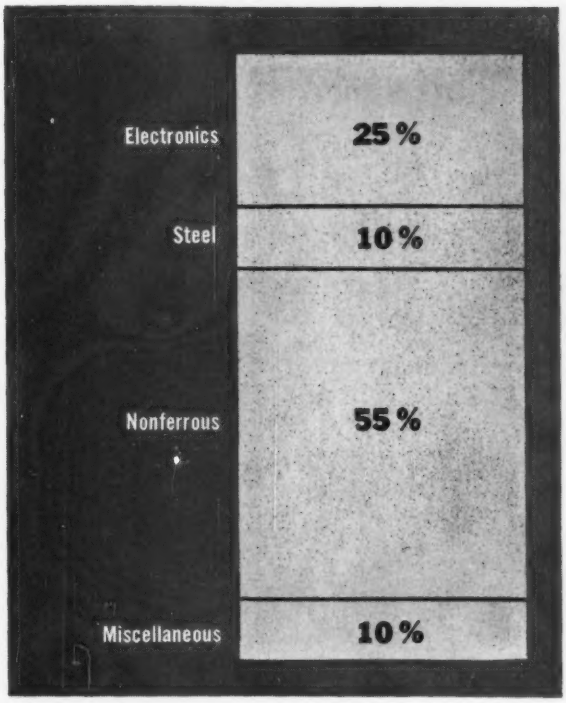
It all adds up to this: nonammonia uses for nitrogen are growing at a rate indicating a doubling or tripling in five years. And this should continue for at least a decade. The 17,460-million-cu.ft. shipments reported by the Dept. of Commerce were valued at $27.9 million. By '70, that should be 80-90 billion cu.ft. and it should be a $125-150-million/year industry.

Price and Volume: It's possible, however, that the increase in dollar sales will not correspond to the increase in volume because of pressure of competition and increase of bulk sales. Both of these would push the unit selling price down.

Industry figures indicate an average selling price of 15.5¢/100 cu.ft. for nitrogen. However, the average represents a broad range—from 2¢/100 cu.ft. for over-the-fence sales to as high as $2.00/100 cu.ft. for cylinders. A good average for cylinders is probably $1.40/100 cu.ft.; for bulk (in trailer trucks), 35¢/100 cu.ft. It should be remembered, however, that there will be wide variations in individual contracts, depending for one thing on the distance from the shipper.

Cylinder sales, despite their high value, are a tricky business for the producer. An average cylinder weighs 115 lbs., holds 220 cu.ft. and is worth $40. The 220 cu.ft. are equivalent to 16 lbs. of nitrogen, worth 4.5¢ at pipeline prices. That's why this side of the business is called cylinder handling. It takes a 115 lb. cylinder worth $40 to move 15 lbs. of gas worth 4.5¢. (This same relationship, of course, applies to other gases sold in cylinders.)

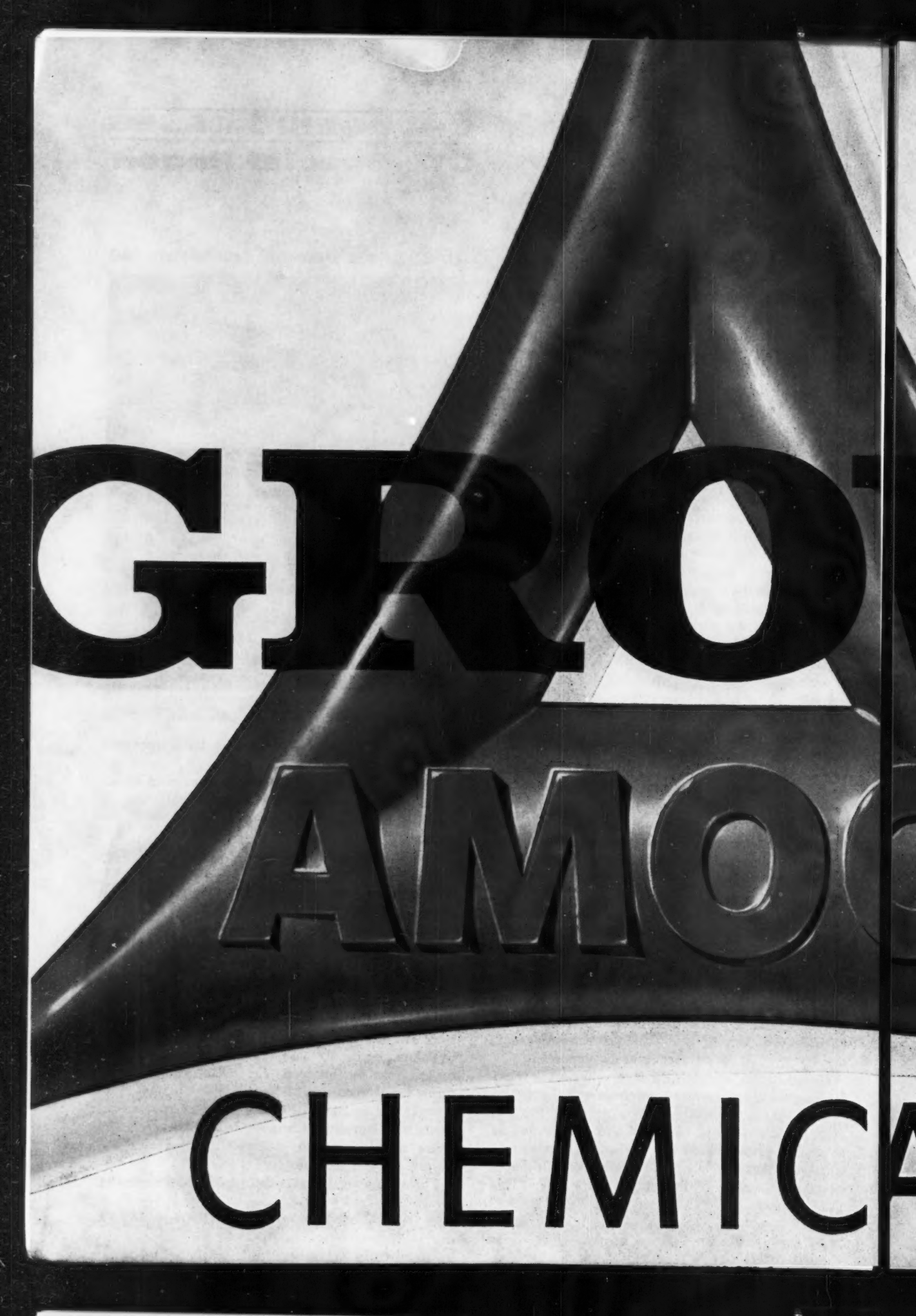
U. S. Argon Demand Breakdown, '60



It's also why producers prefer bulk sales in trailer trucks. The volume ratio now is probably 10 to 1 in favor of bulk over cylinders. And it's likely to increase.

Pipeline sales of nitrogen are growing. Air Reduction, for example, is building a pipeline complex for both nitrogen and oxygen at Claymont, Del. (*CW, Aug. 26, p. 23*). But although there are growth possibilities, chances for on-site sales are not nearly so bright as they are in oxygen (with the possible exception of ammonia). The ideal situation is one in which an air-separation plant can fill a need for both oxygen and nitrogen. This is common in the steel industry, which has substantial needs for nitrogen in processing steel. It's also true in ammonia plants utilizing partial oxidation. However, many chemical companies using oxygen vent the nitrogen. The reverse is true, too. Firms like National Distillers, Texaco, Sun Oil, need nitrogen for ammonia and vent oxygen. An extreme example is Petroleum Chemical Industries, which operates neighboring units at Lake Charles, one for oxygen and one for nitrogen.

There are several factors that tend to complicate the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decision to buy nitrogen through an on-site arrangement. The volume of use is important. But so is the load pattern. A number of applications require large volumes of nitrogen during peak periods. The rule of thumb (with all the handicaps of such): at requirements of 500,000 cu.ft./month, a company should start thinking about an on-site or captive plant if it has a requirement for at least one quarter of the nitrogen that would be generated. Imagine, for example, a company needing at peak periods 5,000 cu.ft./hour. That would mean, ideally, 3.7 million cu.ft./month. If the total monthly requirement was only 900,000 cu.ft., it would probably have difficulty justifying its own air-separation plant.

One company that disagrees with that, however, is Superior Air Products. Its new nitrogen cycle (licensed from Petrocarbon Ltd.), it says, is geared to vary output with demand from 0 to 100% of capacity. But up to 10% of the product can be delivered as liquid for back-up for peak demand or emergency. Plant size ranges from 3,000 to 100,000 cu.ft./hr. and at 1¢/kwh. power, operating costs can be as low as 1.5¢/100 cu.ft.

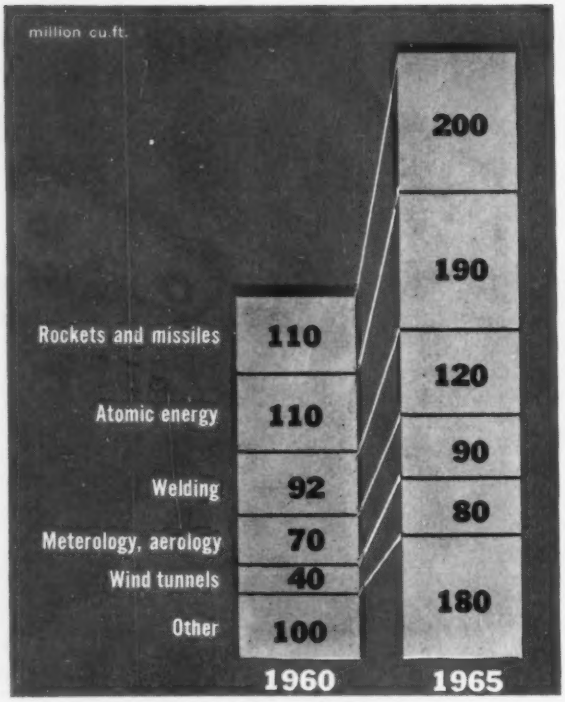
The purchase of cryogenic nitrogen also must be weighed against use of an ammonia dissociator or an inert gas generator. In the dissociator, ammonia is converted to nitrogen and hydrogen. In cases where the presence of hydrogen can be tolerated, such a device is highly economical. It can be particularly attractive in bright annealing where 95% nitrogen and 5% hydrogen is a popular atmosphere.

Inert gas generators (made by more than 30 manufacturers), in which the oxygen is removed by burning are also hard to beat where high purity is not required. Normally, they produce a gas of 87%, with moisture and hydrocarbons the main impurities. Hiking this to a dry, 98% product is relatively easy. In fact, at least two companies now say they can produce a high-purity nitrogen with inert gas generators. Air-separation people point out that each step in purifying it adds to the cost of the product and the price differential narrows.

ARGON

Argon affords an extreme example of growth and headaches of the whole industry. In the two years between '58 and '60, the Commerce Dept. reports production increased 51% (to 570 million cu.ft.), shipments increased 56% (to 593 million cu.ft.) But the value of shipments increased only 8% (to $14.5 million). And actually, the picture is even more discouraging to the industry than the figures indicate. The industry selling price for argon in liquids and gases in cylinders and bulk comes to 5¢/cu.ft. But over half the dollar volume transferred is in cylinders (146 million cu.ft., valued at $7.5 million). The average cylinder price is now about 7¢/cu.ft. And that represents at least a one-third reduction from what it was just a few years ago.

U. S. Helium Consumption, '60 vs. '65

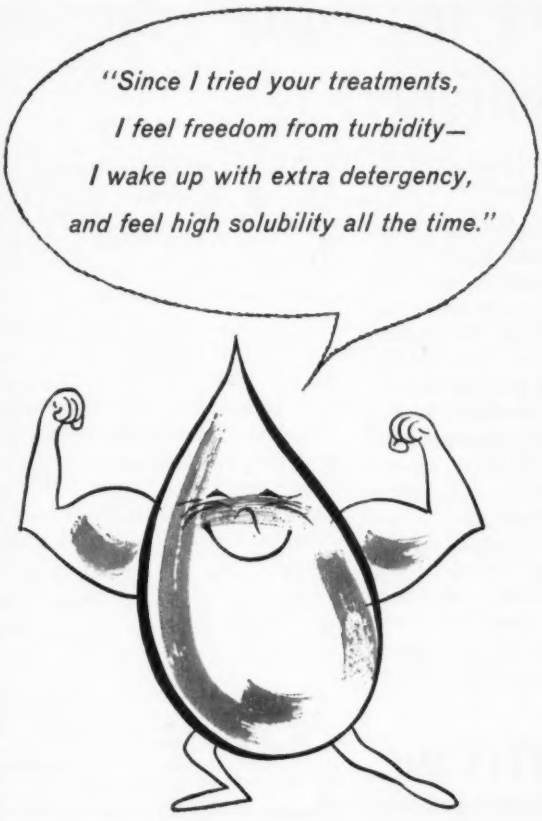


The trouble in argon stems partially from the big buildup in air-separation capacity and big expectations for growth that never quite materialized.

In Two Steps: Argon makes up 0.94% of the air, therefore ranks next to nitrogen and oxygen in abundance. It boils between the two, closer to oxygen. So getting a crude argon (90-95%) is fairly simple. It involves putting in extra plates in the air rectification column. It can then be purified by the "deoxo" process, burning with hydrogen to remove oxygen, the major impurity. Further low-temperature rectification removes traces of nitrogen and other impurities.

The additional investment required to take out a crude cut is nominal—about $100,000 for an average oxygen plant. The investment for refining it is considerably more, approximately $250,000. A number of companies building air-separation plants have installed extra rectification needed to pull argon out. Some have installed refining capacity in anticipation of a booming market in treating titanium and zirconium.

A few years back, the signs pointed to a need of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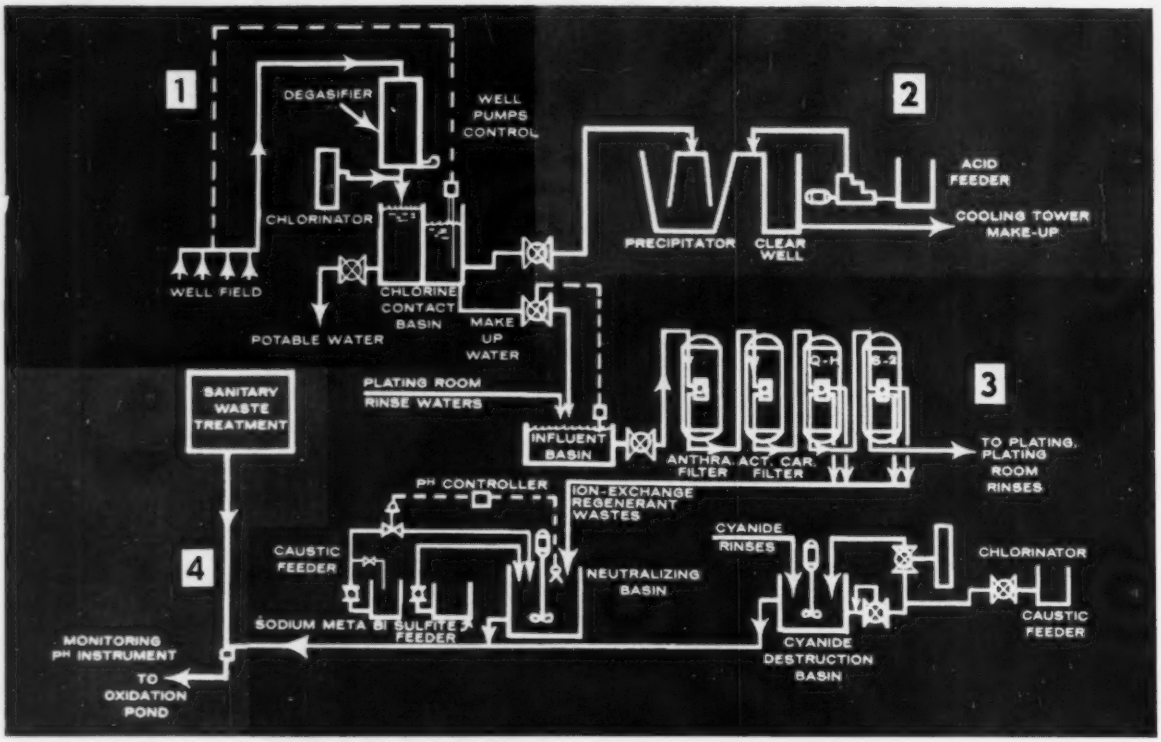

How many of these water and waste treatment ideas can you use profitably?

From water source to waste disposal this new system now serving the Electro-Mechanical Research Company, Sarasota, Florida, is packed with ideas that can help *you* solve similar problems—and each idea was brought to reality with equipment supplied by Permutit.

1. Well-water treatment (upper left in diagram) handles a minimum flow of 160 gallons per minute from a well field—84 gallons for industrial cooling, 10 gallons for plating rinse make-up, and the balance for potable use. All this raw water is degasified and treated in a Permutit equipment system.

2. Cooling water undergoes further treatment (top right) for reduction of carbonate and bicarbonate alkalinity, by means of a Permutit® Precipitator and acid feeder.

3. Plating room rinse-water demineralizing (center and lower right). A complete Permutit system saves water, saves heat, treats regenerant wastes, and provides high-quality demineralized water for plating rinse. Make-up and plating rinse water is processed through an anthracite filter to remove suspended solids, a Carbo-Dur filter to remove organics, a Permutit Q-H cation exchanger, and a Permutit S-2 anion exchanger. This demineralized water is then ready for use. After plating rinse operations, water is recycled, treated and re-used. Wastes —including cyanide rinses, regenerants, and others—are batch treated.

4. Sanitary waste treatment (lower left) was designed to handle 20,000 gallons per day, treating them first in an Imhoff tank, followed by high-rate bio-filtration, secondary clarification and chlorination.

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1 cu.ft. of argon for each pound of titanium sponge produced and another cubic foot for processing the metal. With prospects for a billion-dollar business in titanium and zirconium, things could not have looked better for argon.

The metal market has never lived up to expectations. Moreover, advances in vacuum processing came along at a rate faster than expected. For the gas industry, the net result has been more capacity than demand.

Linde, for example, at one time had things pretty much to itself in argon and still accounts for about half the output. But it has installed refining capacity for triple what it is now producing. And it has a crude capacity for six times its present production.

How to Cost It: The problem now is how to set the price of the product. Operating costs for turning out argon are only nominal, the big cost factor is the capital investment. The selling price then depends on the approach taken by the producing company.

If it's considered as a by-product, it can be sold considerably cheaper than the present price. If, however, it is treated as a coproduct and made to assume a share of the entire plant investment it is greatly underpriced.

The overcapacity may get worse before it gets better, too. At one time, argon separation was considered economical only in large plants. Now, for oxygen plants of 10 tons/day, companies start thinking about argon. Also, Spencer Chemical is now the only company to recover argon from an ammonia plant in the American Messer-designed unit (*Dimension, p. 64*). This produces probably 4-5 million cu.ft./year. There are probably 30 other producers who could also produce argon if they could market it profitably.

On the bright side, argon is now cheaper than helium and will probably get a bigger play in welding applications. Substantial uses also exist in lamps and vacuum tubes. And although the titanium and zirconium market has been growing steadily, other metals (columbium, molybdenum and others) may eventually prove good customers for argon. The hope is that the market will double over the next five years. The uncertainty: whether prices can be held at a level that will encourage the expenditures necessary to exploit its possibilities.

HELIUM

Helium production rose eight fold in the years from '50 to '60, when it reached a record of 642 million cu.ft. Indications are that it will grow at a rate of 10-15%/year to reach 860 million cu.ft./year in '65 and over 1.3 billion cu.ft./year by '70.

The big news in helium is the government's conserva-

DIMENSION

Willard Morrison–Man with an Idea

Willard Morrison, fresh out of college, started to work for the White Motor Co., where he received a $1,000 check from the president of the company for an invention dealing with changing hard-rubber covered cast iron wheels. Then and there, he decided to become an inventor.

In the time since, he has found time to invent the "no-draft" window in automobiles, the Deepfreeze, a blood plasma freezing device and the Liquefreeze system. He also dreamed up the scheme for liquefying natural gas in which part of the pressure is supplied by the gas well itself.

"I have," he says, "in the vicinity of 300 patents." Evidences of the rewards of his inventions are everywhere in his estate in Chicago's suburb, Lake Forest.

One of his latest ideas in refrigerated shipments is for a rubber-reinforced collapsible container with collapsible insulation. He reasons that most of the food shipments move west to east or south to north. Insulation takes about 20% of the space on a car or truck, even more on a container. Since this 20% is about equal to the profit margin on frozen foods, it would be advantageous to eliminate the insulation on the return trip carrying durables. His answer (British patent 790,655) is an insulated container about the size of an 8-ft. cube that collapses to 8 ft.x8 ft. x 1.5 in. At least one major rubber company is expected to offer a commercial model soon.

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GULF

tion program: The U.S. Bureau of Mines intends to store 50 billion cu.ft. of helium underground in the Amarillo, Tex., area. The extraction of natural gas is a two-step method, depending on the liquefaction of all products except helium. The first liquefaction produces a crude containing 60% helium, the rest nitrogen, and it's this crude that the Bureau of Mines will store. The second liquefaction hikes purity to 98%. This is refined to 99.9% helium by chemical absorption.

Two contracts to purchase the crude have been let —to Helex Co. (subsidiary of Northern Natural Gas, Omaha, Neb.) and to Cities Service Helex. Another 10 companies have submitted bids. It's not certain just how many will be let, but the feeling in industry is that 6-8 plants will be built to conserve 135 million cu.ft./day. This would mean a capital expenditure of approximately $50 million. Some, however, feel that the ultimate conservation may run to a billion cu.ft./day and the capital investment for this would be $200-300 million.

In either case, the cryogenic engineering firms are eagerly looking forward to the project. Air Products feels it is on the inside track, points with pride to the fact that it engineered the cold box portions of the two most modern helium plants: the Bureau of Mines' facility at Keyes, Okla., and the Kerr-McGee plant in Pinta Dome Field, Ariz. The latter, the first private helium plant in the country, works on an unusually rich natural gas; it contains 8% helium. Linde, which built the first plant in the country to extract helium from natural gas for the government (in '17), formed Helium, Inc. (with Kansas-Nebraska Natural Gas) and hopes to build a helium extraction plant near Scott City, Kan. Hydrocarbon Research and others also expect to do some business in helium plant construction.

The major share of the market for helium is military (*see chart, p. 80*) Nonmilitary gaseous markets are not expected to grow significantly. One reason is that in conjunction with the conservation program, the Bureau of Mines is going to raise the price to commercial distributors. Now paying 1.9¢/cu.ft., they'll soon be paying 3.5¢/cu.ft. or more. The effect on the "retail" price is not established. It now averages about 7¢/-cu.ft. The added cost of the gas would mean a raise to 9¢/cu.ft. However, the industry might well take advantage of the occasion to compensate for other added costs and raise it to 10¢/cu.ft.

Liquid helium, which boils at —452 F, 7.7 F above absolute zero, is nailing down a tremendous amount of attention and research dollars. How this will translate into helium markets is hard to say. Not much is sold today. But some feel that the market in nonfederal cryogenic helium will reach 25 million cu.ft./year by '65.

The difficulty in trying to measure this market is that although gigantic research strides are being made almost daily in projects involving liquid helium temperatures, many of the ramifications are not yet understood.

Key to the interest is that at low temperatures many materials take on brand-new properties. Some compounds become superconductors and diamagnetic (i.e., completely repel a magnetic field). Some brittle substances become ductile, normally ductile ones shatter like glass. Superconductivity is the property being utilized in attempts to build new supermagnets, which could have a revolutionary impact in a number of fields (*CW Technology Newsletter, Oct. 7*). The combination of superconducting and magnetic properties of some materials is being exploited in the development of the cryotron, a switching device. The market for this as a logic element in computers alone could approach $100 million/year. Its attraction; it could shrink a room-size computer down to a unit slightly larger than a loaf of bread. The cryogyro, a vacuum containing a superconductor floating on a magnetic field, is expected to have a drag only one-one hundredth that of conventional models. The market in missiles could be $100 million/year. It's not being thought of for surface ships, but it could find jobs in submarines.

The maser, which operates at liquid helium temperatures, is already being used in radio telescopes and experimentally, in communications systems. It's the clue to a practical commercial communication system based on an echo satellite.

LIQUID HYDROGEN

For hydrogen, as for nitrogen, ammonia is far and away the most important use: U.S. ammonia capacity represents a requirement of approximately 840,000 tons of hydrogen. However, neither that nor hydrogen used in methanol is cryogenically produced. The current liquid hydrogen capacity, 72 tons/day, is small by ammonia standards. But, because of its high value, it's a $50-million/year industry. It's growing fast, too, and capacity will probably reach 100 tons/day by '65.

Production of liquid hydrogen comes largely from three plants. The Air Force has two in West Palm Beach, Fla. (built and operated by Air Products) with capacities of 30 tons/day (Papa Bear) and 15 tons/-day (Mama Bear). Linde operates a privately financed 6-tons/day plant at Torrance, Calif. In addition, Stearns-Roger operates a 2-tons/day plant at Bakersfield, Calif., Air Products, a similar unit at Painesville, O.

More capacity is on the way. Linde is building a 30-tons/day plant at Ontario, Calif. Air Reduction is

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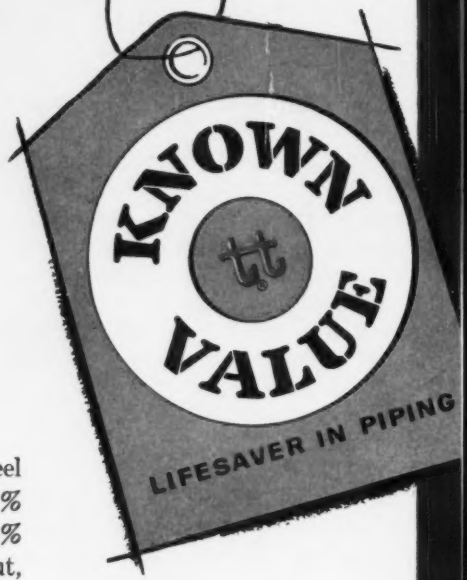

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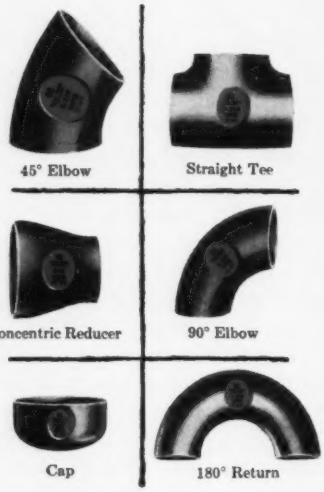

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putting a 6-tons/day plant up at Marcus Hook, Pa. National Cylinder Gas is putting up a small plant—1 ton/day or less—which it will operate more as a pilot plant than as a commerical unit. And the National Aeronautics and Space Administration is likely to seek bids on another plant before the year is over (*CW Technology Newsletter, Aug, 19*).

The big outlet for liquid hydrogen is as a rocket fuel. Because of its high heat of combustion and low molecular weight, it is the "ultimate" chemical fuel. It has, moreover, a sort of built-in factor to combat obsolescence: Many of the propulsion systems proposed for future generations of rockets (e.g., nuclear propusion) will depend on liquid hydrogen as the working fluid.

Prospects of nonmilitary uses for liquid hydrogen are not too bright. Some will undoubtedly be used in electronic and other cryogenic applications. It can also be hauled easily by trailer and used as a gas in the same way as nitrogen or oxygen can. However, the future for hydrogen in that regard must be assessed against this background:

There are about 50 places in the U.S. where byproduct hydrogen is available at an average cost of about 5¢/100 cu.ft. At demands of 5 million cu.ft./-month, it's possible to buy a Girdler generator and obtain hydrogen at 30¢/100 cu.ft. For smaller demands, 1 million cu.ft./month, an electrolytic generator can provide oxygen for 30-50¢/100 cu.ft.

The present price for liquid hydrogen is believed to vary from 50¢ to $1.75/lb., equivalent to 26-91¢/-100 cu.ft. A buyer with a requirement of 1 million cu. ft./month might want to weigh the costs of liquid hydrogen against the costs of an electrolytic generator.

METHANE

At the moment, liquid methane amounts to a gleam in the eye of a group of design engineers. But it could easily become the biggest cryogenic product of the group.

There are two attractive outlets for it: as a means of transporting methane to gas-short countries and in "peak shaving" for natural gas in the U.S. Either one could become a billion-dollar business.

The transportation project that has been getting the most attention is the one of Conch Methane Serices, Ltd. This was originally conceived by Willard Morrison as a means of taking natural gas up the Mississippi for the Union Stockyards (*CW Technology Newsletter, Oct. 22, '55*). The Prince family interests have retained 20% of the rights, the other 80% is shared equally by Royal Dutch/Shell and Continental Oil. With the *Methane Pioneer*, a prototype vessel, Conch proved it feasible to ship liquid methane by making seven trips from Lake Charles, La., to Canvey Island, near London.

Reportedly, arrangements have been made by Conch, the Gas Council of Great Britain and a group of French companies to ship gas from the Sahara to the United Kingdom. And, as Morrison sees it, the costs beat by a wide margin those of making town gas from coal. His reasoning: Gas made from coal is worth 65¢/1,000 cu.ft. but contains only 550 Btus./cu.ft. Methane, on the other hand, has 1,100 Btus./cu.ft. He estimates that flared gas from Lake Maracaibo, Venezuela, can be liquefied and carried to England by ship for 50¢/1,000 cu.ft. (total cost including amortization at recognized banking amortization periods).

However, the National Coal Board and Gas Council in Great Britain are looking at four sites for another big coal gasification plant. The chairman of the coal board reports his conviction that town gas can be made from coal as cheaply as importing methane.

If the importing of methane wins out over coal gasification, England could wind up importing 100-200 million cu.ft./day. Japan, another likely customer for liquid methane, might take 150 million cu.ft./-day. Each of these could be $100-million ventures. Other possible routes for liquid methane: Sahara to northern France, Libya to Italy, South America to any of several places.

A number of firms have been working on projects. J. F. Pritchard, Hydrocarbon Research and others have done a great deal of work. Air Products is working with shipyards in Italy and Japan, is prepared to undertake the entire project. It reports it's ready to take ships anywhere. If told the amount a customer is willing to pay for gas anywhere, the company says, it can tell him whether or not the project under consideration is feasible.

Cold Storage: Liquefying methane, as some see it, is the logical solution to the problem of gas companies that have big loads in the winter, small demands in the summer. Feelings are mixed on this, however. One possible drawback is the recollection by many people of the East Ohio Gas Co. explosion on Oct. 20, '44. The company was storing liquid methane when it blew up killing 140 people. Techniques of handling liquid methane and general knowledge in the field have advanced tremendously since then, of course, and no engineer in the field sees any hazard in such a project. However, the recollection might be a psychological barrier to many.

But the idea is still in an early stage. And it will

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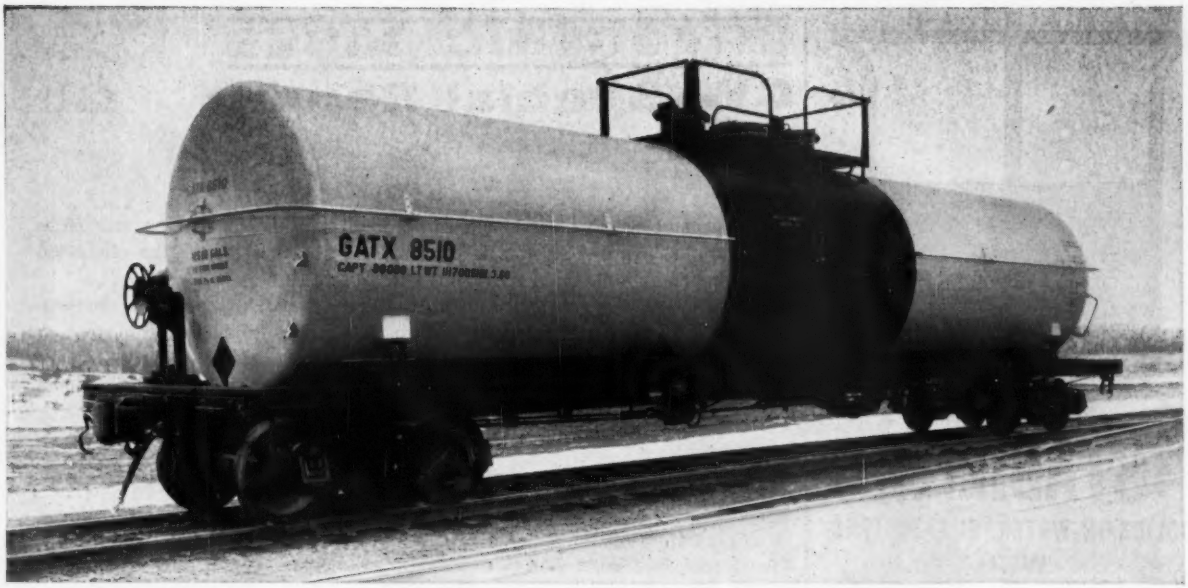
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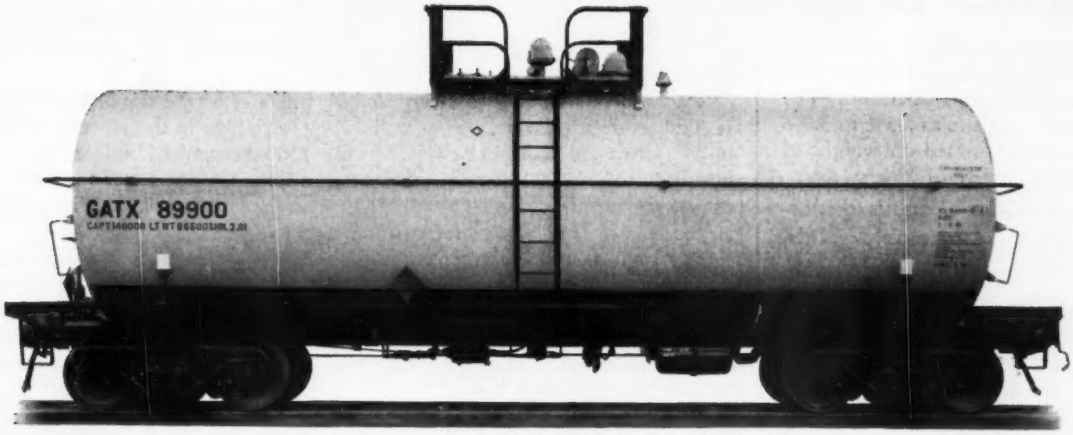
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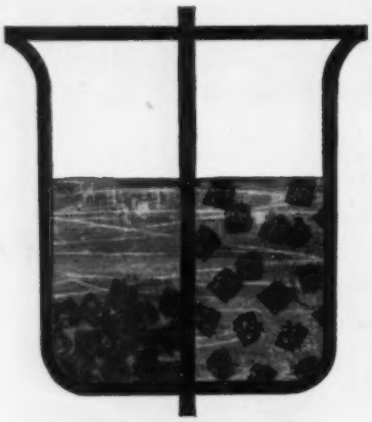

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CRYOGENIC GASES
CW Special Report

have to compete with other means of accomplishing the same thing, storage in underground caverns, bigger sale of gas for other uses during the off-season (e.g., air conditioning and sales to industrial users).

If the technique is accepted by the utilities, it would mean an enormous market for cryogenic engineering and materials. Air Products is prepared to offer a warehousing service. Pritchard has an unusual idea: it would like to see someone just place the liquid methane in a large hole in the ground, insulate it, then use the cold value of the gas as it is allowed to expand.

RARE GASES

The five rare gases (helium, argon, neon, krypton and xenon) are all produced in air-separation plants, although the amount of helium so produced is insignificant, compared with that from natural gas. While helium and argon have moved out of the "rare gas" category, they are both sold in small quantities and high purities as rare gases.

General Electric recovers some rare gases and one material is coming into the U.S. from overseas suppliers. At present, however, Linde and Air Reduction dominate the market.

Because there are only two major producers, figures on the size of the market are hard to get. It has been growing, however—35-40% in the 10-year period, '48-'58. The total business now is between $500,000 and $1 million and involves sales of 300,000 liters of gases. It's growing at a rate faster than in the past. If some of the "blue-sky" applications currently under investigation should gel, the market could easily double in the next five years.

Aside from helium and argon, neon is the biggest volume gas of the family. It's present in the air to the tune of 18.18 ppm. (compared with 9,340 ppm. for argon), and sells for as little as $1.50/liter in 100-liter cylinders to as high as $7.50/liter in borosilicate flasks. Its main use is in the sign industry; it imparts a characteristic red to orange-red glow. By mixing with other rare gases, the color can be changed.

In mixture with other gases, neon is used in voltage regulator tubes, Geiger-Müller tubes, glow lamps, fluorescent tube starter switches and sodium lamps.

Next to neon is krypton (presence in the air: 1.14 ppm) which sells for $5.50/liter in 100-liter cylinders, $20/liter in single liter quantities. Its use is mainly in the electronic and lamp industries. Its high atomic weight reduces evaporation and heat losses, permitting operation of lamps at higher temperature. New York City, for example, uses krypton-containing lamps in traffic lights because they last longer. Krypton-85, the radioactive isotope, is finding use in medicine, leak detection, etc.

The rarest of the gases, xenon (presence in air: 0.086 ppm.) is also the most expensive, selling for $30/liter in 100-liter cylinders; $50/liter in single liters. Its density (and inertness) have helped it find jobs in scintillation counters. Its electrical properties are close to mercury's and since it will not condense readily at low temperature, it is used to supplement mercury vapor in some thyratron tubes. It has anesthetic properties, producing a state close to "natural sleep." Its drawbacks on that score, outside of its price, are that the level needed to anesthetize is perilously close to the amount needed for asphyxiation.

Looking to the Future: Widespread research is now in progress on environmental atmospheres for outer-space applications; the use of gas plasma in thermionic devices; and inert materials for use in nuclear devices under extremely high pressures and temperatures. All of this work involves rare gases. Neon, for example, is now being studied as a possible replacement for highly corrosive materials used as coolants in small atomic engines. Such projects hold great promise for expanding markets for all rare gases.

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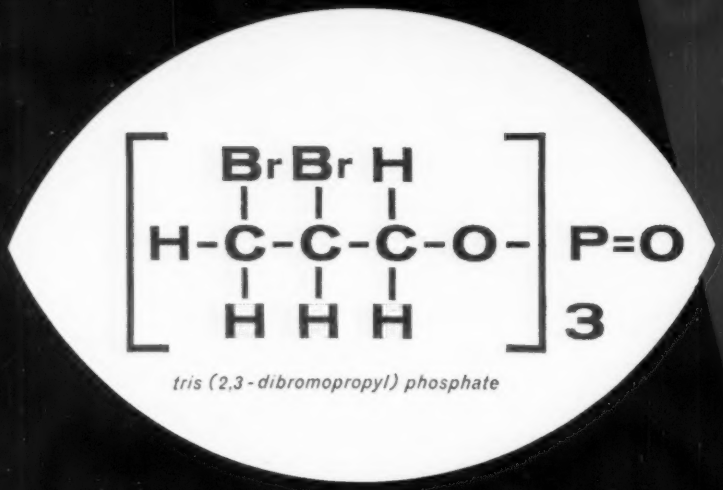

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Technology
Newsletter

CHEMICAL WEEK
October 14, 1961

News on distillation columns—one big, one small:

• Standard Oil (California) is putting in what is described as the "world's largest petroleum refining tower"—height of a 27-story building. It will fractionate *o*-xylene from highly purified feedstocks for the firm's phthalic anhydride operations.

• A pilot-size distillation tower fabricated from columbium will be shipped this week to Phillips Chemical Co. (Idaho Falls, Ida.). The column, to be used in electrolytic dissolution studies, is 10 ft. long, consists of nested tubes 7 in. and 5 in. in diameter. Fabrication was done by Dresser Products Inc. (Great Barrington, Mass.). Significance: columbium's corrosion resistance is almost as good as tantalum's. But columbium is about half as dense, consequently considerably cheaper on a volume basis. Moreover, prospects of a lower price are much brighter for columbium than for tantalum. Use tests such as Phillips will carry out will help determine columbium's place in the chemical process industries as an anticorrosion weapon.

•

Converting underground steam to electricity, a long-discussed project for Venezuela, is reportedly moving ahead. Chemical Natural Resources, Inc. (New York City), which has been negotiating with the Venezuelan government for 17 months, says that although a number of details remain to be ironed out, the project has been agreed upon in principle. The company hopes to arrange financing now, then start construction.

The first installation planned: A 12,500-kw. electrical generation plant, eventually to be boosted to 100,000 kw. The company will share profits (50-50) with the Venezuelan government. Later it will study recovery of chemical by-products. Steam wells (geothermal steam) have been tapped in Italy, New Zealand and California to generate electricity.

•

A new high-speed device for testing tensile properties of single fibers was described this week at the fall meeting of The Fiber Society in West Point, N. Y. It was developed by Fabric Research Laboratories (Dedham, Mass.) for Celanese.

The device measures tensile properties at elongation rates in excess of 1 million %/minute. It's designed to operate within the range of velocities and strain rates that fibers are subjected to during processing from fiber to fabric. Existing instruments operate at extremes of speed (e.g., the Instron Tensile Tester at 1 in./minute; ballistic impact testers at velocities as high as 2,000 ft./second). The new machine fills the gap—in the range of 5-150 ft./second.

Technology Newsletter

(Continued)

A new continuous bleaching process for synthetic and natural fibers has passed its first tests with flying colors, according to Olin Mathieson Chemical Corp., its developer. The process, called Textone, is based on sodium chlorite, reportedly has been used in one mill at speeds up to 450 yds./minute double strand.

Costs are said to be equivalent to or lower than those of conventional bleaching methods. Features of the process, says Olin: it promotes more dyeability, increase bleaching, yields higher fiber strengths and softer hand.

As Olin sees it, sodium chlorite has long been recognized as the ideal bleaching agent for cellulosic and other fibers because it achieves a maximum of bleaching with no fiber degradation. But it has been limited to batch processing because of odor and corrosion. Olin's new process is said to side-step these problems with only minor equipment modifications.

•

A new thermoplastic packing for gas-liquid contact systems will be marketed by Dow, through Saran Lined Pipe Co. (Ferndale, Mich.). Dow has tested the packing, called Maspac, for seven years in a variety of applications.

The dump-type packs will be available in two sizes: (1) A nominal 3¾-in.-diameter packing, which is made from general-purpose polystyrene, low- and high-density polyethylene and polypropylene, and (2) a nominal 2-in.-diameter packing, which is made from high-density polyethylene and polypropylene.

The packings, originally developed for Dow's internal use, say Dow engineers, are comparable to 2-in. Raschig rings at one-third the pressure drop. Unit costs are about double those for ceramic packing and are competitive with other plastic packings.

•

Studies on a new oral penicillin, effective against resistant staphylococci are being unfolded in New York City this week. It's semisynthetic 5-methyl-3-phenyl-4-isoxazolyl penicillin, called Prostaphilin, is made by Bristol Laboratories. Studies reportedly show it to be more potent against diseases caused by *Stahpylococcus aureus* than Bristol's Staphcillin, which must be administered by injection.

•

Six U. S. cities will know more about atmospheric pollutants as a result of monitoring systems being installed by Beckman Scientific and Process Instruments Division (Fullerton, Calif.) under a $276,000 contract from the U. S. Public Health Service. In Chicago, Cincinnati, New Orleans, Philadelphia, San Francisco and Washington units will measure and record concentration of sulfur dioxide, nitric oxide, nitrogen dioxide, carbon monoxide, hydrocarbons and oxidants. Goal: to obtain information for a special study on effects of motor vehicle exhausts on health.

molten sulphur

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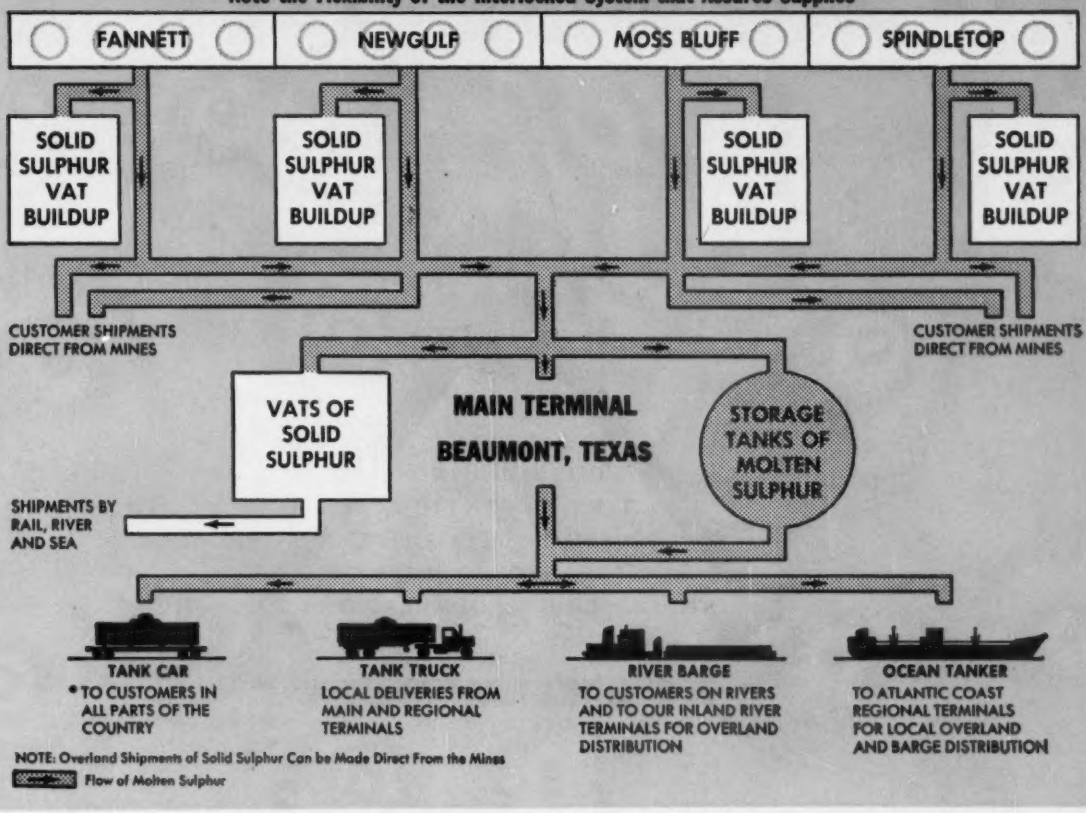
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Celanese CHEMICALS

CW PHOTO—DWIGHT DOLAN

SLC's President Jean-Joffre Gourd: Ready to make his play for columbium concentrate markets.

Playing a Strong Columbium Hand

St. Lawrence Columbium and Metals Corp., Ltd. (Montreal, Que.) is this week turning up its first three cards in a tight play for a big stake: the U.S. columbium ore market—now valued at about $5 million/year and predicted to boom to $25-million/-year proportions by '65. A novel concentrating process dominates SLC's hand, but it has two other cards almost as important:

(1) The company holds an estimated 62.7 million tons of columbium ore at a relatively convenient spot (Oka, Que., only 30 miles from Montreal). This ore is about 1% pyrochlore, with a columbium pentoxide content of 50-60%. Its total reserves could yield roughly 500 million lbs. of columbium pentoxide.

(2) It also has a local market for mine tailings. These reduce by about 50% the net cost of its open-pit mining operation, estimated at 70¢/ton.

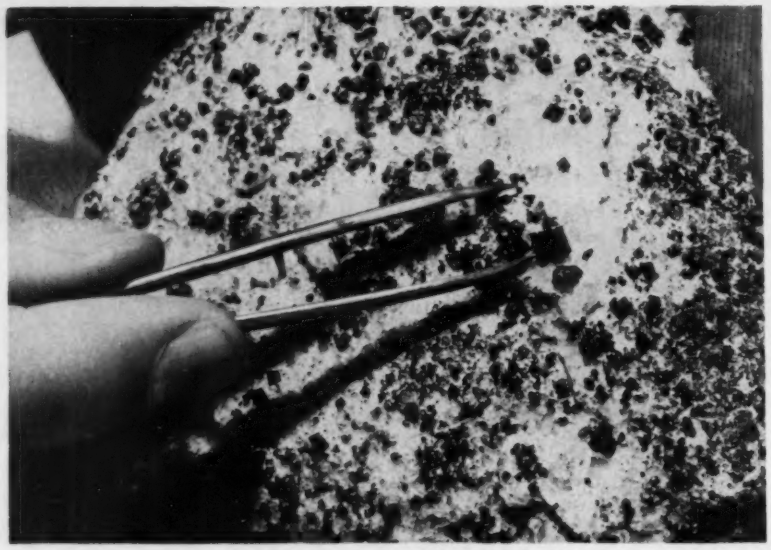
The concentrating process, reserves and by-products markets thus put SLC in the position of being the only company in North America to have both potentially economical mines and a pyrochlore concentration process. But the company has yet to sign long-term contracts for sale of concentrate; and, despite pilot-plant successes, the recoveries its commercial units will make are still not proved.

Among the firms competing with SLC for the potentially giant columbium markets are Kennecott Copper, which is tied in with Tin and Associated Minerals, Ltd., of Nigeria and has access to columbite ore in Nigeria; A. S. Norsk Bergverk, which has a pyrochlore mine in Norway; and Wah Chang Corp. (which has a pyrochlore mine in Brazil).

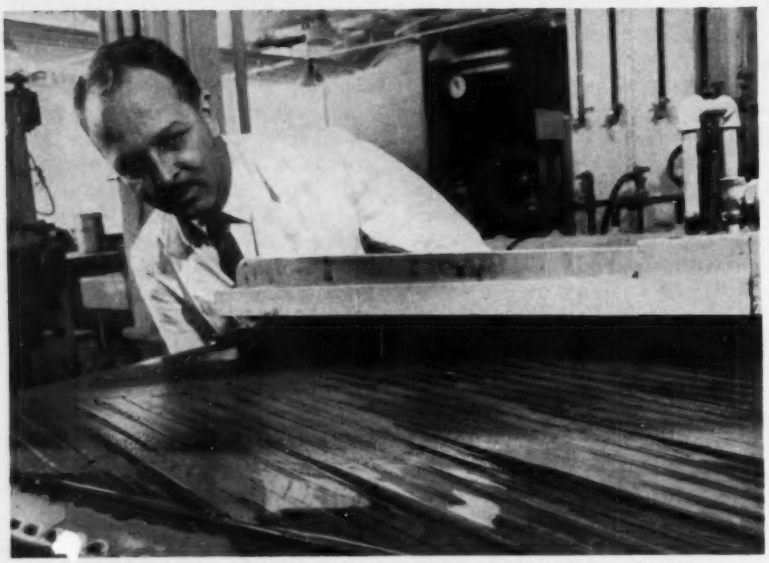
Proof in the Product: The process on which SLC is betting is now getting its big test at the company's brand-new mill at Oka. On hand at a showing on Sept. 22, were some 9 tons of specification-grade pyrochlore concentrate. This material was produced during the first 10 operating days after ore was brought into the mill. While it is only a fraction of the product that will be turned out when the mill reaches its design capacity (roughly 2 tons/day of concentrate) it hints that the mill startup is progressing smoothly. And SLC claims that only one week later the mill was able to produce 2 tons of pyrochlore during one 12-hour period. Recoveries: about 80%. Inside the mill, the commercial flotation process was opened to inspection even as it was being broken in.

This process includes only minor variations from a pilot process de-

Prospector examines drill cores made for SLC assay reserves.



Lower tweezer prong points to pyrochlore crystal in the ore.



Jean Faucher, SLC's ore-dressing expert, studies pilot classifier.

veloped by the firm at Ecole Polytechnique at the Université de Montréal. Briefly, ore is: (1) crushed and milled, (2) passed over shaking tables (*picture at left*), (3) passed through a separator in which a magnetized roll lifts magnetite (ferrous-ferric oxide) from the slurry, (4) thickened in a conical settler, (5) passed through a series of flotation cells to separate: first pyrite, then apatite and calcite, then mica and other silicates—leaving a pyrochlore concentrate.

Familiar Process: Conventional flotation reagents manufactured by Dow and American Cyanamid are in use. But SLC has not disclosed what the exact reagents are. Otherwise, ore-dressing experts will recognize the process as not unique.

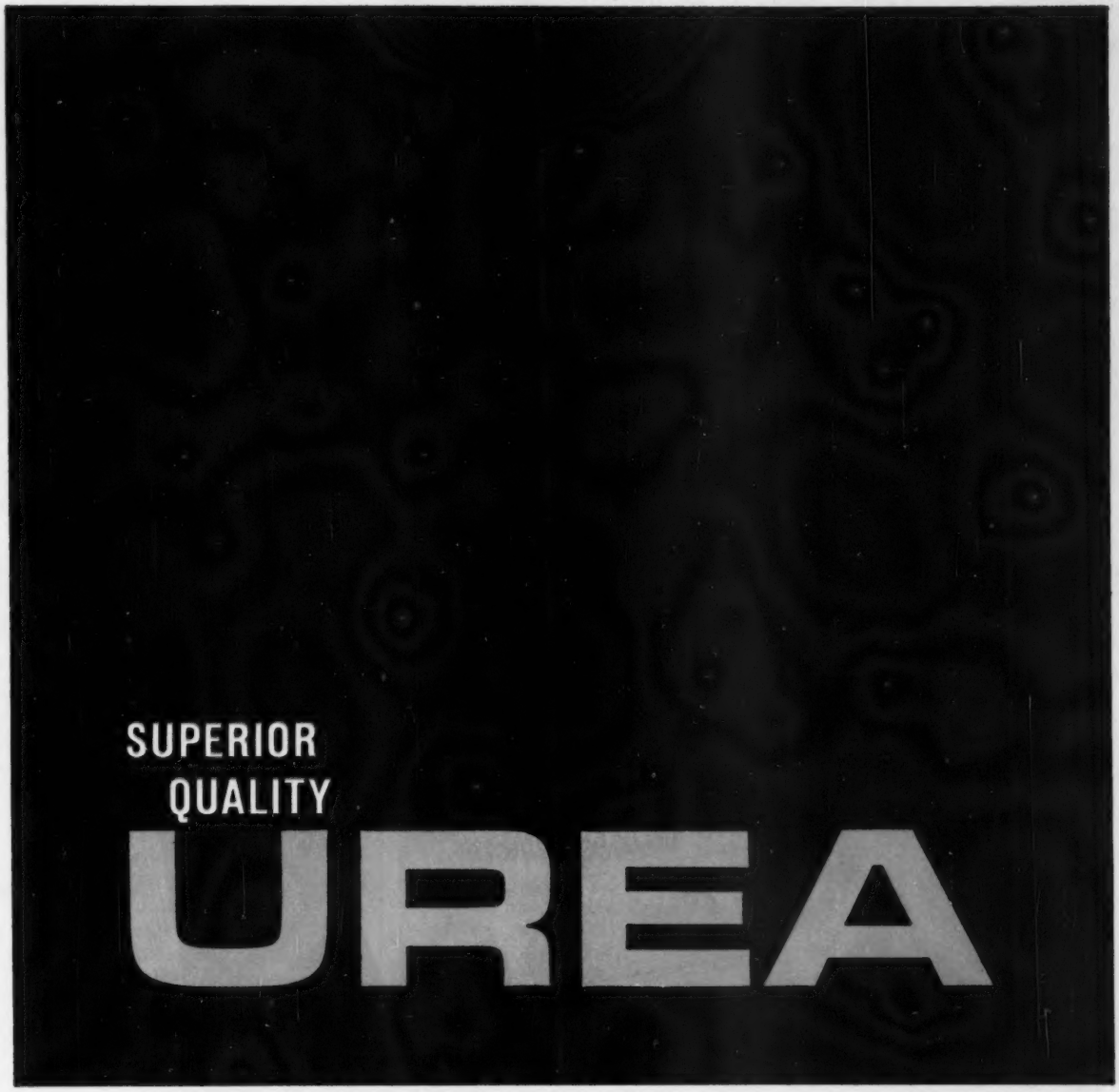
Three novel aspects of the mill's design, however, are likely to affect profits:

(1) The quality of the rock feeding the mill can be maintained. It is kept constant by blending crushed ore of varying columbium content (as determined by assay) from a seven-hopper storage bin onto a conveyor belt.

(2) The mill has triple-decked shaking tables—a rarity in North American mill operations. These tables, which stand about 7 ft. high in two lines, five batteries deep, remove calcite rock from the heavier pyrochlore. Resonant vibrations, which would result if the shaking tables were fastened to the floor, have been avoided by hanging the tables from the ceiling girders by wires. And the mill's steel framework has been designed so that stresses flow to the outside, then down to the ground. Cement block walls (which are necessary in Canada's cold climate) are spaced away from the framework.

(3) Part of the mill's $2-million investment cost has gone into a system to separate recycle water from the waste slurry leaving the process. Slurry is pumped out of the mill through Dorr thickeners and a filter. These separate a cake from the recycle water. Results: fresh-water consumption is reduced from about 600 to 350 gals./minute, and there is no drainage problem typical of most mills where the wet slurry is dumped onto the ground.

Floating Duty-Free: In sight of the mill is an open-pit quarry, where the firm has "blocked out" (tested) its



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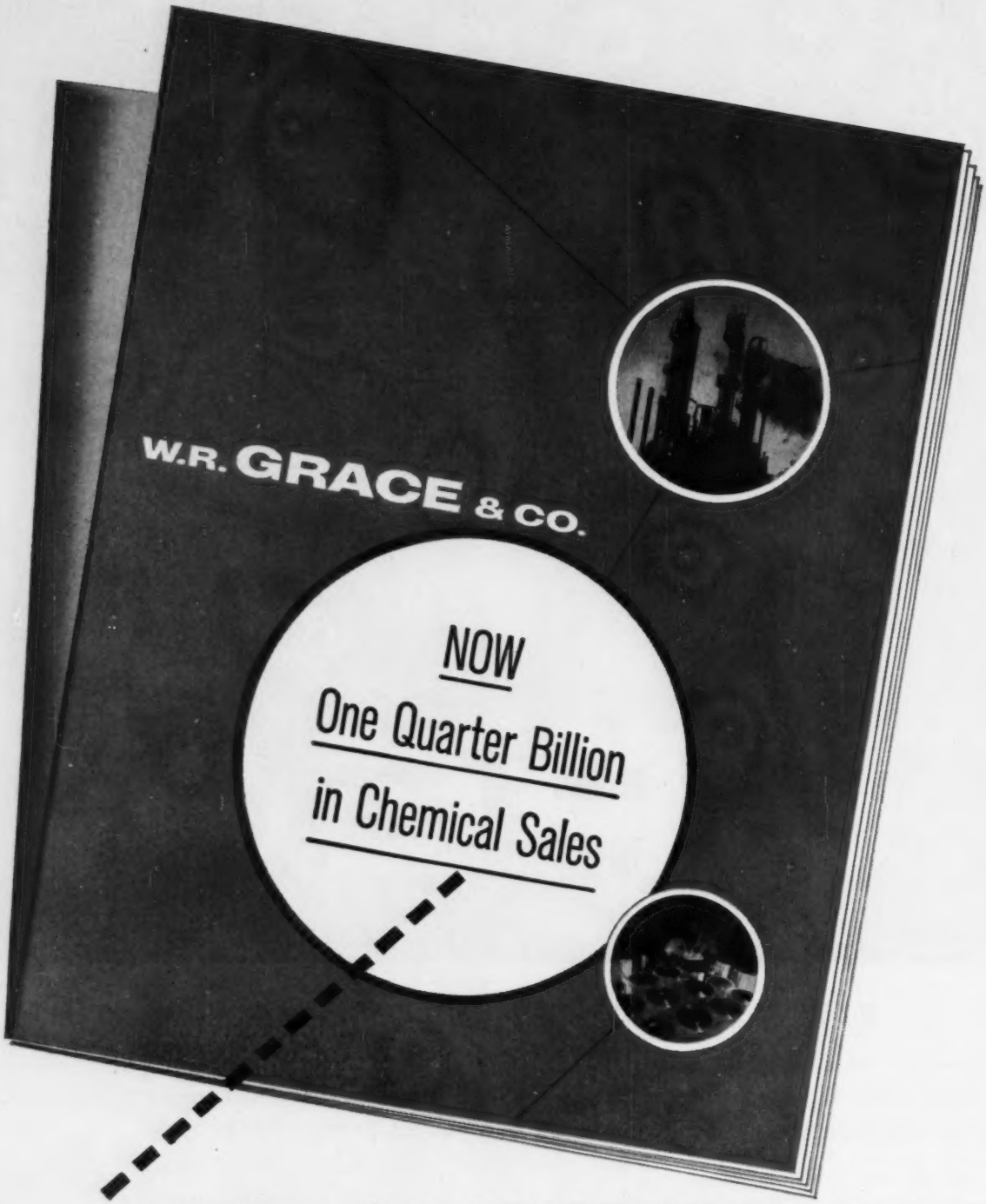

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first million tons of ore—which will yield about 8 million lbs. of columbium pentoxide. In addition, there are "proved" reserves of 17.6 million tons and "indicated" reserves of about 44 million tons. All this ore has a computed average columbium pentoxide content of about 8 lbs./ton.

More important than the total columbium content of the rock is the analysis of its contained pyrochlore, which is the product of the flotation process. Pyrochlore, a complex oxyfluoride of columbium and calcium, is known to vary in quality between 45-70% columbium pentoxide. And if its quality drops off, the quality of the salable concentrate from flotation declines too. A producer might try to get around this with acid treatment; but the moment the ore is subjected to a chemical operation, it is subject to a 15% U.S. import duty.

Uniform Findings: For this reason, St. Lawrence Columbium has made exhaustive tests on its holdings, drilling some 14 miles of diamond-drill holes into the rock at various spacings throughout the property to pull up cores for analysis (*picture p. 102*). In all this drilling, the pyrochlore has never analyzed below 50% columbium pentoxide (with 52% the minimum for 17.6 million tons of proved ore), nor ever above 60%. And this sets the concentrate guarantee: columbium pentoxide (over 52%), cesium oxide (3-6%), tantalum pentoxide (0.09-0.5%), titanium dioxide (4-6.5%) silicon dioxide (0.5-3%), phosphorus pentoxide (0.2-0.8%).

Tantalum Ratio: Designed to process 500 tons/day of ore—1.4 million lbs./year of columbium pentoxide—the new mill has capacity to supply almost half the columbium consumed in the U.S. during '60. The only source that may surpass this capacity is the mills of Nigeria, which turn out columbium concentrate in the form of columbite, a black mineral compound of columbium, tantalum, manganese and iron in solid solution.

Columbite ranges from nearly pure columbium oxide to nearly pure tantalum oxide; most of it averages a columbium-to-tantalum ratio of 10/1. For this reason it has become customary to market concentrates on the basis of the combined columbium-tantalum content. And U.S. government specifications have divided stockpiled concentrate into three grades,

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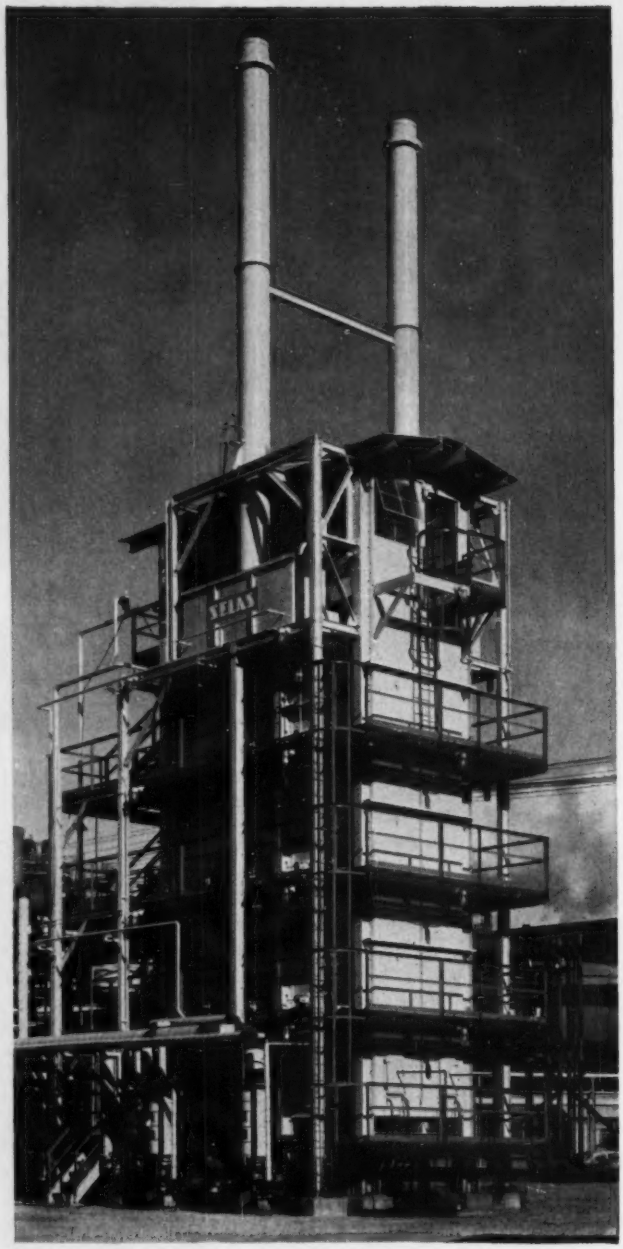

An outstanding feature of Gulf Oil Corporation's new oxo alcohol plant in Philadelphia, Pa., is the unique design of the Selas furnace which permits simultaneous production of synthesis gas and relatively pure hydrogen, in one firebox containing no internal partition walls.

A variation of the Selas GRADIATION® furnace widely used for ethylene and hydrogen production, this design utilizes DURADIANT® burners which focus energy on the process coil, thereby permitting use of two or more process coils—operating at different conditions—in the same firebox.

Through use of multiplicity of strategically-located burners in the Selas furnace, horizontal bands, or zones, of radiant energy are created. Result: close control of critical tube wall temperatures down the length of the vertical catalyst-packed tubes in the process coil.

Two similar Selas furnaces will soon go into oxo-synthesis service in other petrochemical installations.

Technical details on the application of this type Selas unit for production of hydrogen, methanol-synthesis gas, and oxo-synthesis gas are contained in a paper "Catalytic Steam Reforming of Light Hydrocarbons For The Production of Hydrogen and Synthesis Gas," presented by Selas engineers at the A.I.Ch.E. annual meeting, February 26, 1961, in New Orleans.

Copies of this paper are available. Write to Mr. R. J. Kenard, Fluid Processing Division.

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depending on the ratio. Best grade contains columbium to tantalum in the minimum ratio of 10/1.

Why Separate? But columbium and tantalum are very similar chemically, and separation of the two is difficult. At the same time, pyrochlore, in comparison with columbite, is nearly free of tantalum. SLC, for example, is touting a concentrate that contains a columbium-to-tantalum ratio varying from 100/1 to 500/1.

This presents a strong attraction to manufacturers of pure metal; they must resort to complicated extraction processes to purify their columbium concentrate. But it apparently fails to impress the makers of columbium compounds and alloys. These firms (Kawecki Chemical, Mallinckrodt and Union Carbide Metals), etc., say that the columbium-tantalum ratio merely directs the concentrate to one or more of a variety of possible end-products. Reason: when columbium is used as a low-percentage alloy (e.g., ferrocolumbium), the concomitant tantalum can go with it without any bad effects. But columbite is sold by its combined tantalum-columbium content, so these customers end up paying for tantalum they don't use.

Steel Steals the Show: Thus, pyrochlore's low-tantalum advantage is hardly likely to get much play until pure metal production brings the major demands for the concentrate. Today's most important columbium market—the market that has mushroomed within almost a few months and which could quintuple the industry's columbium concentrate production before the end of '65—is mild steel manufacture.

Mild steel, or low (0.35% maximum) carbon steel, is the workhorse of the industry, and is used for structures, pipe, pressure vessels, etc. Most of it, as covered by American Society of Testing Materials Specification 235, has a tensile strength of 65,000-77,000 lbs./sq.in. (Grade A) or 70,000-82,000 lbs./sq.in. (Grade B). Yield strengths, on which design calculations are made, are half that.

But as early as '58 Great Lakes Steel Corp. (which has pioneered development) found that adding minute (0.01-0.04%) amounts of columbium raises the strengths of low-carbon steel 30-50%, at an additional cost of only $3-10/ton. This represents an over-all savings of about 16% to the

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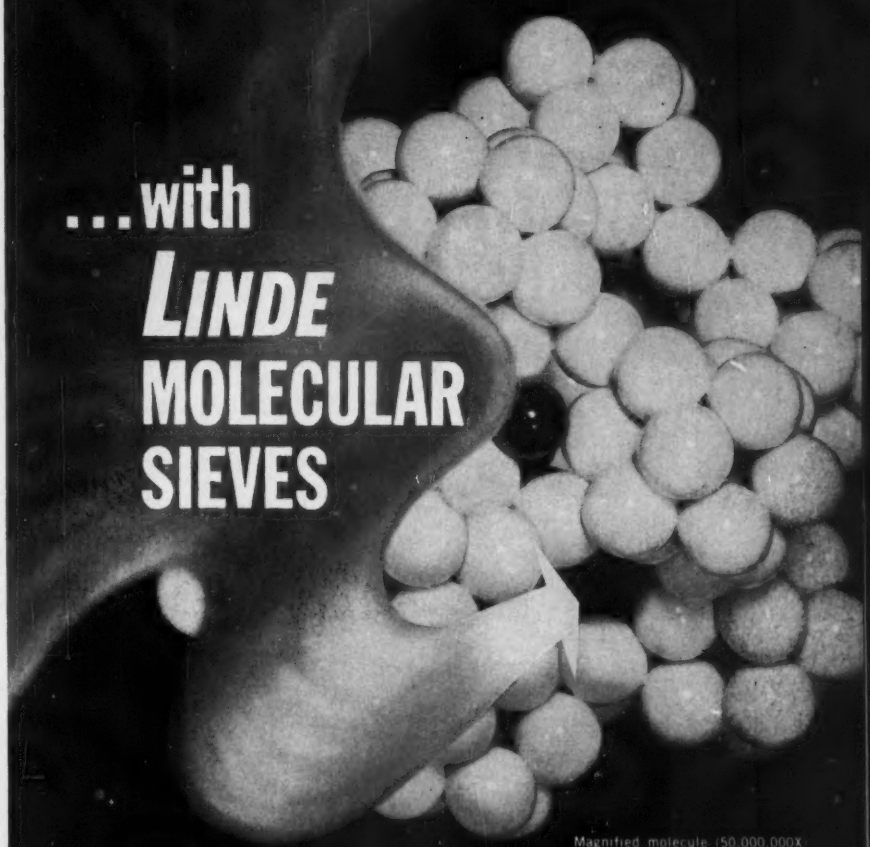

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(Calcium Stearate)

GENERAL PROPERTIES

Type of salt:	Di
Physical form:	Impalpable powder
Particle size:	Average 5-7 microns
Color:	White
Odor:	Bland
Bulk density:	20 lbs. per cu. ft.
Melting point:	147°-149° C. (determined by gradient bar)
Moisture:	0.6%
Iodine number:	2 maximum
Arsenic:	Less than 0.2 ppm.
Total Heavy Metals:	None detected
Solubility:	Insoluble in water, alcohols, esters and ketones. Slightly soluble in hot benzene, toluene, xylene, carbon tetrachloride, vegetable and mineral oils. Soluble in hot pyridine.

For further details, write for Bulletin No. 55

**The fatty acids used in the manufacture of this product are derived from food grade edible tallow that has been subjected to the Chick Edema test*

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S-81

customer, who has found that he not only saves weight but also gets better corrosion resistance and toughness, with no sacrifice in welding or cold-forming qualities.

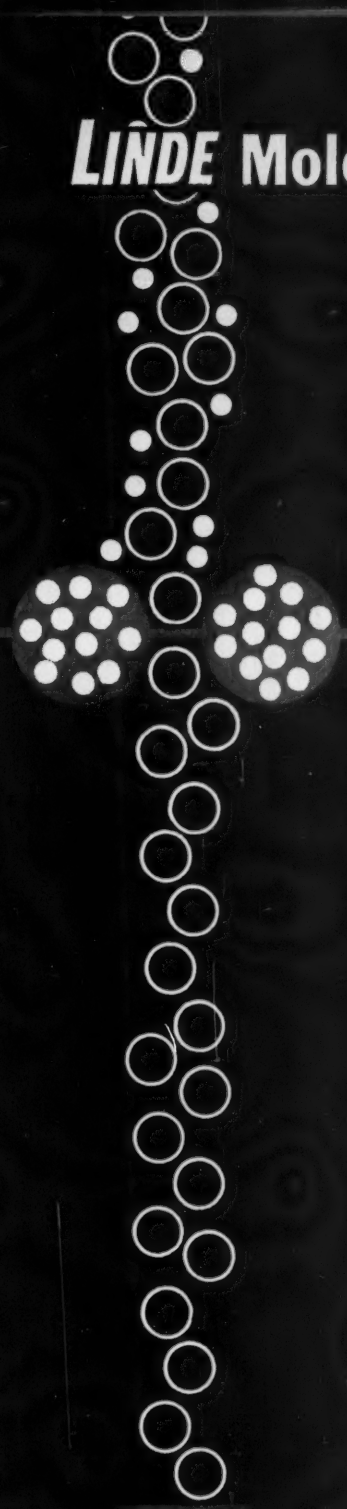
Why does columbium improve carbon steel? It gives it finer grain (improves strength and toughness); it dissolves impurities (makes welding easier); and it deoxidizes the molten metal (improves corrosion resistance through better ingot formation).

Led by the chemical process industries, specifically the gas pipe industry, customers have been quick to specify columbium-treated steels. And within a few years Armco Steel Corp., Jones & Laughlin, National Steel Corp., U.S. Steel and others have offered columbium-treated steels. One of the most recent developments comes from Universal Cyclops Steel Corp., which says it has a columbium-treated chrome steel (ASTM 430) that gives superior performance in automobile bumpers, trimmings, etc.

All this adds up to a market for ferrocolumbium that looks as if it might include 25 million tons/year of steel as early as '65. Since each ton of treated steel contains about ½ lb. of columbium, it represents a market for about 25 million lbs./year of columbium concentrate (approximately 50% columbium).

Big Question: With good markets probable, and estimated costs of only 35¢/ton to get the ore into the mill, one major question faces St. Lawrence Columbium: Will actual costs meet the optimistic estimates based on its pilot-plant studies? It won't have a positive answer for several weeks. And its Oka operation can never be considered a total success until this is known.

But SLC has collected top-notch French-Canadian technologists to handle the operation. Already, in the complex financial-technical scramble to locate claims, these men have brought the company out on top with a choice property. Working at Ecole Polytechnique, they have piloted and designed a process to recover pyrochlore, although many U.S. experts said it couldn't be done. And they have designed into the commercial mill some features that already make it outstanding. SLC thinks its chances are good that the same staff will be able to bring its process to full capacity and efficient operation.



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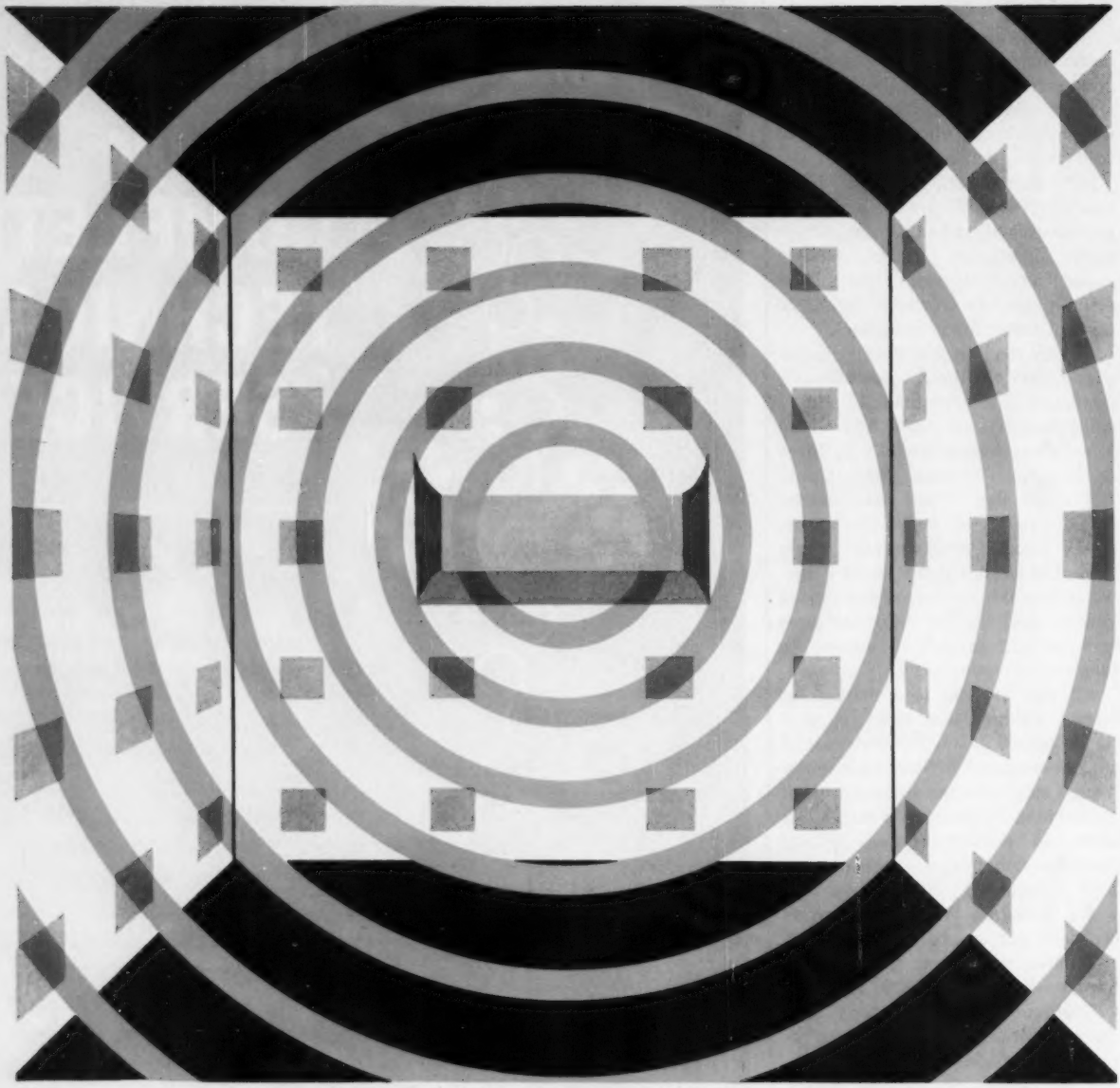

Ceramic Engineers at Ramtite mix imagination with Alcoa Aluminas to produce super refractory: 90-RAM

An example of the outstanding refractories The Ramtite Company has developed for steel mills is 90-RAM—a 90 per cent alumina ramming mix. Originally used to line laboratory furnaces in Ramtite's own research department, 90-RAM proved its dependability in 60 months of trouble-free service. Now it is being used in many of the largest steel mills for such versatile applications as continuous heating furnace hearths; facing of burner walls and side walls in slab reheating furnaces; forge heating furnace hearths; ferrous and nonferrous melting furnaces; soaking pit slag lines and in several parts of basic open hearth furnaces.

Advantages of 90-RAM include excellent resistance to very high temperatures, abrasion and deformation. In addition, 90-RAM can be laminated to other refractories, forming a monolithic bond which makes it ideal for facing and relining refractory surfaces.

In meeting the needs of steelmaking and other high-temperature operations with a family of refractory materials, Ramtite *mixes imagination with Alcoa® Aluminas*—for excellence in refractory performance at reasonable cost.

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Purchase price	$11,475
Operational costs	
500 hours/year	$3,130
Annual storage costs	480
Annual insurance premiums	735
Total annual costs	$4,345
Cost/air mile	
500 hours @131 mph.	$.066
Cost/seat mile	
4 passengers	$.016

CPI's Flying Salesman: Still a Lone Eagle

The CPI salesman who wings his way to his customers via company plane is still pretty much a lone eagle. But interest in this mode of transportation for salesmen is picking up, and chemical firms are finding different ways to put their salesmen aloft. Not only are business planes purchased outright but also they may be obtained on a full- or part-time basis through any number of rental, charter and taxi services.

In fact, the latter methods may become increasingly popular as companies realize that the problems of private plane ownership can offset the advantages. Thus one company, Van Guard Chemical (Denver), finds that it may have to replace its twin-engined Beechcraft (capacity: seven passengers) with a smaller Cessna 310. Although a heavy plane was needed to get through frequent bad flying conditions, the firm found it couldn't fill enough seats to allow economical operation.

But this problem does not look as if it will keep Van Guard from using its own planes if they mean entries in the sales ledger. Another company, Kemco Chemical Co. (Houston), chemical specialties firm, reaches more than half its customers with the company's twin-engined Piper Apache. W. L. Eubanks, Jr., president, pilots the plane himself, goes to prospective buyers with technical service and product demonstrations. Because of the plane's range, Eubanks covers a territory stretching from Houston to North Carolina and up the Eastern seaboard through Massachusetts.

Short trips average about 100 miles, while longer ones, like sales jaunts to California, mean more than 2,000 miles in the air.

Although the Apache (cost fully equipped: about $44,000) holds five people, Eubanks spends most of his flying time—about 200 to 250 hours/year—alone or with one other employee who goes along strictly for sales training. The national average for business aircraft: 2.3 persons per flight.

One other firm that follows this lone-eagle pattern is Detroit-based Detrex Chemical Industries. Vincent Pisani, sales manager of the company's Filter Division, pilots his own Cessna 150 (price: about $8,000), which he bought when Detrex hired him three years ago. The company absorbs all flight expenses that Pisani runs up while working his aircraft within a 500-mile radius of Detroit. To sell to the balance of his customers, he turns to the airlines. "Commercial airlines," Pisani states, "provide so many benefits it would be unwise not to capitalize on them." All told, he travels more than 60,000 air miles/year; but Detrex's other salesmen work out of territories that are too limited to warrant anything other than an automobile.

Selling via air travel, though, is a bigger part of the picture at Textile Aniline & Chemical (Lawrence, Mass.), which has three planes — all Piper Commanches (about $24,000 apiece)—in service and, according to company President R. E. Derby, could use more. Although Derby, like Eubanks and Pisani, is licensed to fly, he relies heavily on seven other pilots, trained by Textile Aniline at a cost of about $200 (for private plane rating) to $700-800 (for instrument rating).

All are salesmen and technical service representatives for the firm's dyestuff line. The Commanches wing as far south as Macon, Ga.—about 900 miles from Lawrence—to reach the textile mills below the Mason-Dixon line. In fact, Derby says, most of the 300-500 hours/year spent in the air are flown in this region. His reason: New England, because of its much smaller total area, can be canvassed less expensively by car.

Mountain to Mohammed: Travel by company plane may also be turned around to bring the mountain to Mohammed: one chemical company uses both its DC-3 and Convair 440 to pick up customers, bring them back to the home plants for a well-arranged, detailed inspection tour.

The time spent traveling to and fro isn't wasted, of course, for the same customers make an ideal "captive audience," as one company executive put it, for his firm's sales pitch. Each plane carries three pilots (who can take on the added role of salesman) and a steward. And the airliner-type luxuries of a bar, full-course dinner en route and card tables all make for a congenial, relaxed, good-for-business atmosphere.

The planes spend a total of about

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New Isocyanates

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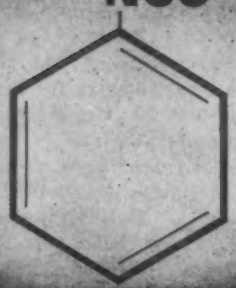

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1,300 hours/year in the air, often taking company personnel on cross-country sales tours. One such trip on tap for the near future: a two-month journey through South America—complete with marketing managers and product specialists.

What It Costs: But the costs of such operations must be justified. Kemco's Eubanks, for one, points to the time saved as the deciding factor in his operations. Example: a five-to-six-hour car drive to Dallas is cut to 95 minutes by his Piper Apache. Eubanks can also fly from Houston to New Orleans during the day, make his calls and be back home in time to spend the evening with his family. The same trip would take a three-day automobile drive and cost a lot more.

The end result of all this, says Eubanks, is that his airplane saves him 100-300% in travel time. One sales trip alone, he notes, paid for the cost of the plane. Eubanks attributes the twofold increase in sales volume—up now to $180,000 after 18 months in business—solely to his flying junkets, which take him to spots not usually covered by commercial flights.

As for Detrex's Pisani, he pegs the flight cost of his Cessna at about $12/hour or about 10¢ for every air mile. And he rates as his greatest asset the almost immediate service he can provide. "I talk to a customer early in the morning. If he's harassed by some problem, I'm personally at his disposal sometime that afternoon." But this service costs. He estimates that expenses from his plane run nearly double the costs of other modes of transportation when time isn't figured in.

Facts and Figures: Initial cost of a private aircraft—like the kind used by Detrex or Kemco — ranges from two to 10 times that of a luxury car. Thus a Cessna 185 Skywagon (single-engine) goes for a bit under $19,000. On top of this are the expenses for insurance (over $1,000/year); fuel (about 40¢/gal.); oil (50¢/qt. and changed every 25 hours); airplane and engine overhaul ($3.60 for every hour of use); and storage ($40/-month). Total operating cost for 500 hours/year: close to $6,500. And this can be pushed up still further by either the cost of training or the salary of a professional pilot.

Problems with Solutions: Expenses like these can make a company plane a heavy drain on finances. Dorr-Oliver's (Stamford, Conn.) West Coast branch dropped its Cessna 180 because the cost of running the plane in the winter became prohibitive. And after the three or four sales engineers who flew the plane left the company or were transferred East, management found it too expensive either to take on a full-time pilot or to train someone else.

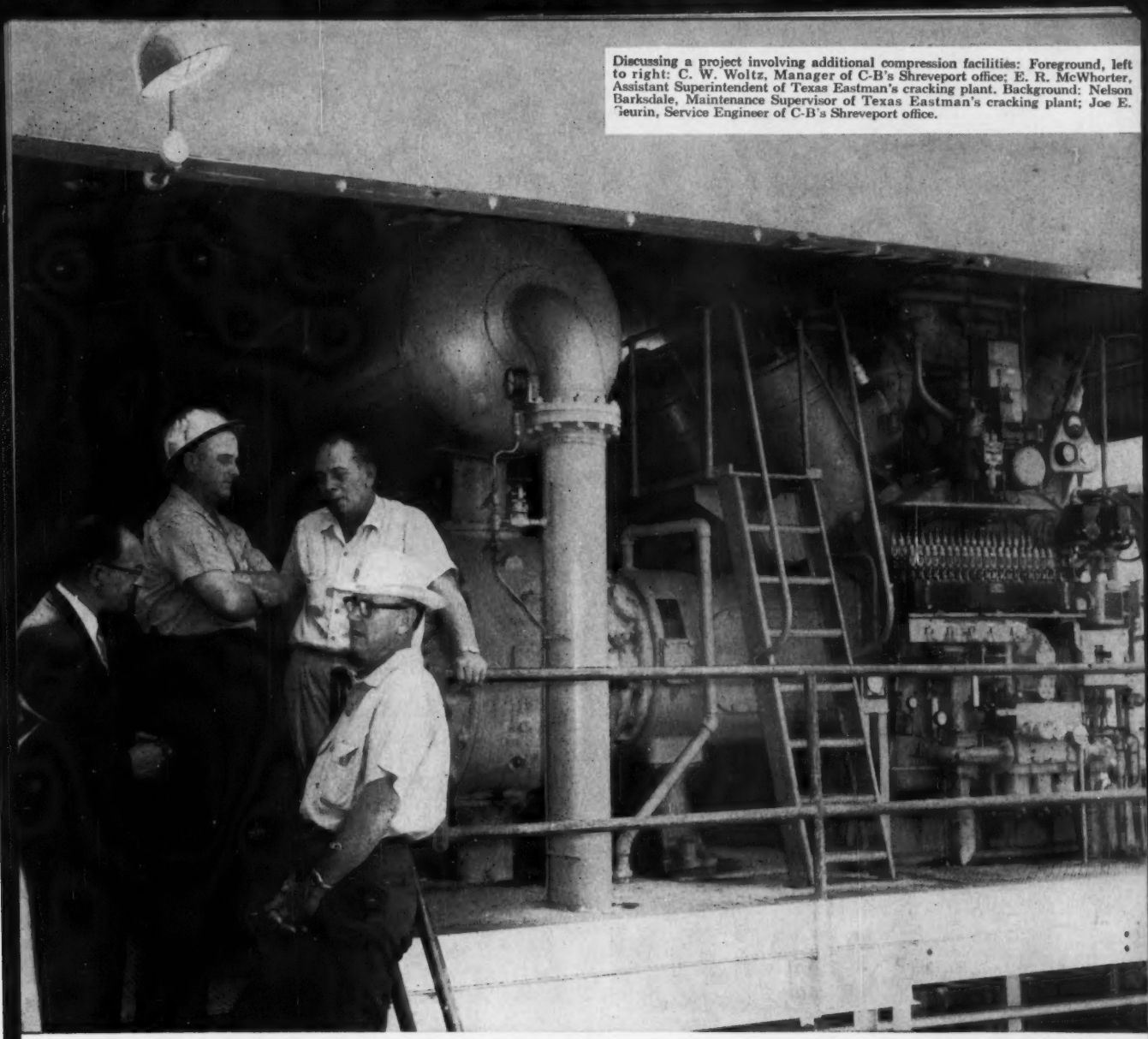
A way out of this dilemma for some chemical companies is simply to hire as potential flying salesmen only those applicants who are already qualified pilots. Yet this puts a tight limitation on sales hiring.

And corporate aircraft present other difficulties too. For one thing, company stockholders frequently object to spending money on such "frills" as planes when a rented car for a salesman might do just as well for less money. Furthermore, the Internal Revenue Service is cracking down on expense accounts, and one of the sorest points concerns a firm's plane, used, according to one industry observer, "90% for pleasure and 10% for business — but fully deducted." Perhaps in line with this is the Kennedy Administration's move to raise the salvage value of business aircraft, which in the end will take a deep bite out of the total cost that management can write off as depreciation.

What all this could do is to drive some companies to the doors of fast-growing rental and leasing services. Their objective: to let these firms handle—for a price—all the responsibilities of business aircraft, from supplying pilots to full maintenance. Two firms that do this: Air Taxi Co. (Red Bank, N.J.), which charges such prices as 25¢/roundtrip mile for a single-engine Bonanza; and Starflite, Inc. (White Plains, N.Y.), which offers long-term contracts at $7,500/-month for a twin-engine Beechcraft.

Magnet Cove Barium Corp. (Houston) has taken advantage of similar offerings. To reach the oil well operators it services in the Southwest and Canada, Magcobar leases 11 planes from Lease Plan, Inc. Reason: this leaves a certain amount of capital for other purposes, and it's easier to make monthly installments than to finance outright purchase.

But the pros and cons of whether or not a company should own or rent planes for its sales staff—or use them



Discussing a project involving additional compression facilities: Foreground, left to right: C. W. Woltz, Manager of C-B's Shreveport office; E. R. McWhorter, Assistant Superintendent of Texas Eastman's cracking plant. Background: Nelson Barksdale, Maintenance Supervisor of Texas Eastman's cracking plant; Joe E. Geurin, Service Engineer of C-B's Shreveport office.

How Cooper-Bessemer on-the-spot service helps Texas Eastman

Since their beginning in 1950, Texas Eastman production facilities in Longview, Texas, have been continuously expanded and improved. And, from the start of this program of progress, Cooper-Bessemer equipment and service have played an important part.

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at all, for that matter—are anything but settled. Eubanks' assertion that it's "certainly a good way to make money in the chemical field" is true enough for his case, but far from a universal rule.

DATA DIGEST

• **Soap:** Brochure describes company's chemically modified soap — Maprosyl 30; it has these features: detergency, low order of toxicity, resistance to formation of hard-water scum. Also described: soap's surface properties, dermatology and applications, which include use in rug and upholstery cleaners, dishwashing aids, shampoos and metal-finishing solutions. Onyx Chemicals Corp. (Jersey City 2, N.J.).

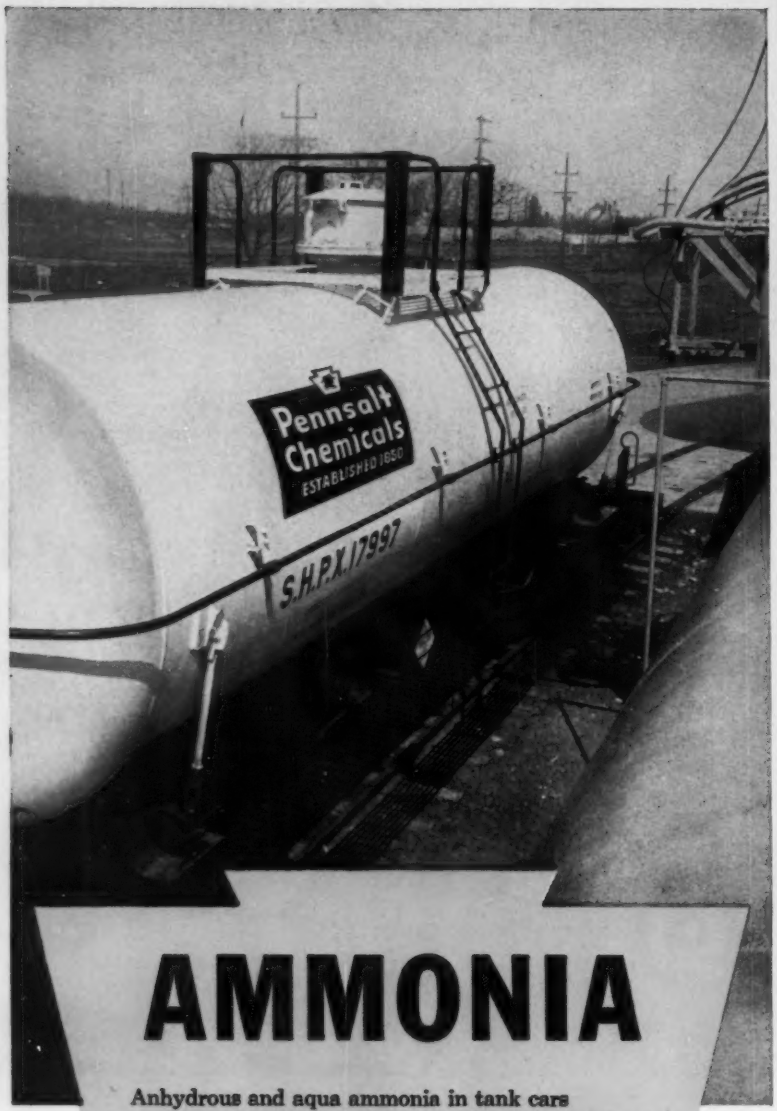
• **Ion-Exchange Resin:** Bulletin reports on 13 case histories that involved company's Amberlite 200 cation-exchange resin. Examples include uses in artificial fiber, plastic film, paper, metal plating and chemical plants. Rohm & Haas Co. (Washington Square, Philadelphia 5).

• **Lubricants:** Sixteen-page catalog outlines complete line of industrial lubricants and details a program to streamline lubrication processes. Lists include the characteristics and uses of more than 60 lubricants. Pure Oil Co. (200 East Golf Rd., Palatine, Ill.).

• **Sulfonates:** Data sheet reports on various sulfonates, listing applications, specifications and physical properties. Also shown: information on test methods and packaging. Chemical Sales Division, Chas. Pfizer & Co. (235 East 42 St., New York 17).

• **Cements:** Bulletin reviews six corrosionproof cements based on epoxy, furan, phenolic and polyester resins and sulfur and silicate materials. Tables detail physical properties and chart lists the cements' resistance to 166 corrosives. Atlas Mineral Products Co. (Mertztown, Pa.).

• **Toluene Diisocyanate:** Technical data sheet gives specifications, physical properties, handling, packaging and storage of company's Nacconate 80, a toluene diisocyanate composed of 80% 2,4-toluene diisocyanate and 20% 2,6-toluene diisocyanate. Prime uses: flexible and rigid urethane foams, elastomers, protective coatings. National Aniline Division, Allied Chemical Co.



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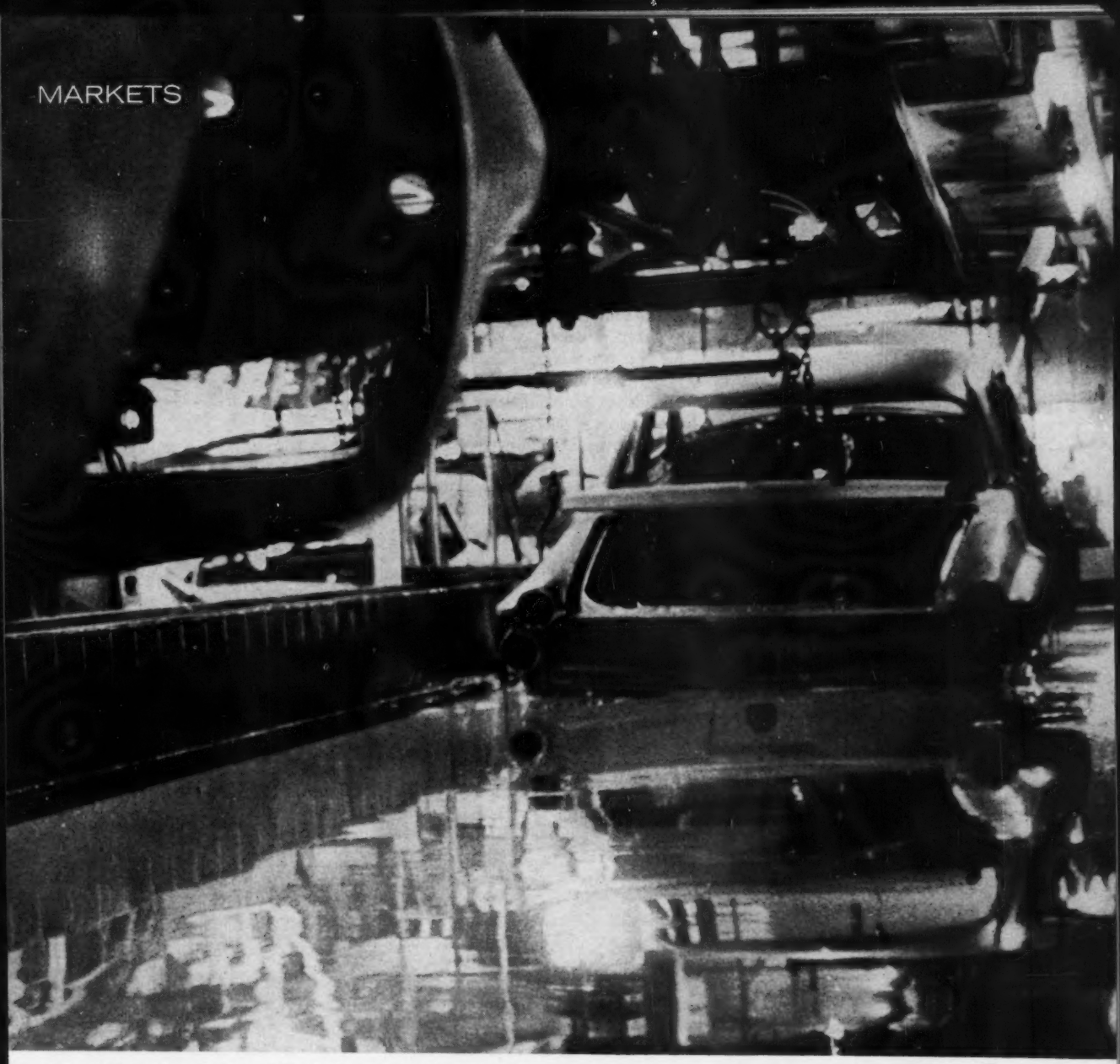

New '62 Dodge Dart unitized chassis is dipped into primer coating as it moves along assembly line.

'62 Models Brighten CPI Outlook

Detroit auto makers, in customary early-season optimistic form, are predicting a banner year for the '62 automobiles, as the first batch of brand-new models appeared in showrooms throughout the country this week.

They expect '62 models to ring up a 22% increase in sales over those of '61. For chemical makers, it could mean the biggest year yet for sales of plastics, aluminum and coatings to the auto industry.

Typical of forecasts is one made by Jack Wolfran, general manager of General Motor's Oldsmobile Division. He predicts that 6.6 million domestically produced new cars will be sold in the next year (vs. 5.5 million '61 models produced). This is not a record, but it would mean record sales of plastics, metals, etc.—use of these materials in the average car has been climbing steadily.

Plastics Paving the Way: One of the big gainers will be plastics. The average '61 car used 25 lbs., accounting for a total of 135 million lbs. The average '62 model is expected to take about 28 lbs. Assuming a 6.6-million-car year, this means a total market of 182 million lbs. of plastics.

Although the trend toward greater use of plastics in auto manufacture is certain, it's still not clear which plastics will take the lion's share of the business. In the '62 models, polyethylene chalked up the biggest poundage gains.

Approximately 2.4 lbs. of polyethylene were used in the average '61 model (0.4 lbs. of low-density material, 2 lbs. of high-density). Total poly-

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The recent price decrease for azelaic acid widens its price advantage over sebacic acid and makes it an even more attractive raw material in its many areas of application. Azelaic acid is in wide use now in low temperature plasticizers, alkyd resins, polyesters and synthetic lubricants. And azelaic, produced from domestic raw materials, is in abundant supply with the start-up of Emery's second production facility.

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ethylene requirements in '61 was about 13 million lbs.

The '62 models are expected to take about 4.6 lbs./car (1.4 lbs. of low-density, 3.2 lbs. of high-density), boosting total polyethylene demand over the 30-million-lbs./year mark. Greater utilization of polyethylene is expected in cowl panels, carpet backing, glove boxes, side shields, etc.

Du Pont's Delrin acetal resin is making substantial progress in winning automotive applications. It has found jobs in over 80 different places in the '62 models, compared with 44 uses in '61. Poundage requirements by auto makers is still small, though. About 2 million lbs. are expected to be consumed in '62 models, compared with less than 1 million lbs. in '61 but it seems clear that the acetal resins have made their mark in the auto industry.

Celanese's new Celcon acetal resin is also expected to compete strongly for a share of the auto market.

Numerous other plastic materials go into autos: nylon, the acrylics, vinyls, phenolics, acetates. But there's little gain so far in the use of these plastics in the '62 models. Nevertheless, increase in total car production this year would lift the over-all demand for these materials.

Who's Scoring: Most dramatic is the success of acetal resins in instrument panels. Both the Dodge Lancer and Pontiac Tempest sport new acetal resin instrument panels, each weighing about 2 lbs.

Polyethylene is making new inroads. Ford is placing polyethylene cowl panels on its Ford and Falcon models, two in each model, each weighing about 0.5 lbs. Chrysler has similar cowl panels, and American Motors' injection-molded polyethylene rear inside quarter panel for the cargo area will see service this year.

In addition, the auto industry will probably use 2-3 million lbs. of polyethylene film to cover seats and convertible tops temporarily during transportation of the cars from factory to dealers.

Using polyethylene carpet backing (about 15 mils thick), Ford, General Motors and Chrysler thermoform the carpeting to fit the configuration of the floor. This eliminates cutting and sewing operations. Only a few of the compacts do not have the new carpet.

At Chrysler, an all-plastic turn signal replaces a metal one. Grease seals for the extended lube joints are neoprene with nylon inserts. New acetal resin bearings support the shift mechanism, and the clutch torque shaft has acetal bushings and seals. These and several other applications are boosting plastics' positions in new-car manufacture.

Aluminum Gains in Autos: And this year in Detroit there's greater utilization of aluminum in autos. The average '61 model used about 63 lbs. of aluminum—auto makers took a total of 340 million lbs. The average '62 model takes about 67 lbs., which will push total aluminum demand to over 440 million lbs. The economies realized by the car manufacturers, as well as the weight savings—and concomitant gas economies to the car owner—are playing an important part in the trend toward utilization of aluminum.

Plastics in Autos . . .

(Figures in millions of pounds)

	'61 Models	'62 Models
Nylon	3.8	4.6
Acrylics	7.6	9.9
Polyethylene (low-density)	2.2	9.2
(high-density)	10.8	21.1
Phenolics	18.9	23.1
Vinyls	32.4	39.6
Polyvinyl butyral	2.7	3.3
Acetate and butyrate	8.6	10.6
Acetal	0.8	2.0
Other	47.2	59.0
Totals	135	182.4

. . . The trend is up

(pounds/average car)

Model		Model	
'40	4	'58	18
'50	8	'59	21
'54	10	'60	22
'55	13	'61	25
'56	15	'62	28
'57	16	'65	40

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Located in the Chicago area, the four buildings illustrated here represent an investment of $20,000,000. They are staffed by 700 outstanding scientists and engineers and are equipped with the most modern research tools available.

Central Research and Engineering, where a "dignified disrespect for the way things are done now" is a creed, is devoted to long-range and fundamental research on the frontiers of packaging. *The Metal Research and Development* facility, the first and the largest of them all, concentrates upon new and improved metal containers and fabricating equipment designed to lower costs, increase speeds and improve quality.

Two other buildings—just opened—complete the picture. *General Packaging Research and Development* brings together the paper, plastics and closure technologies of six product divisions and provides an ideal environment for the development of packages made of combinations of materials. And the new *Glass Research and Development* building will be devoted to an advanced technology for the world's oldest packaging material. This technical package adds one more reason why—

Continental has, and will have, the right package for you!

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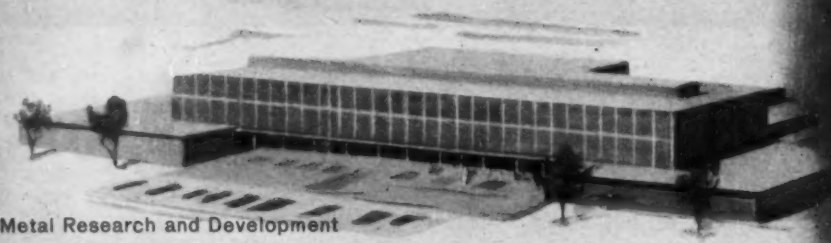
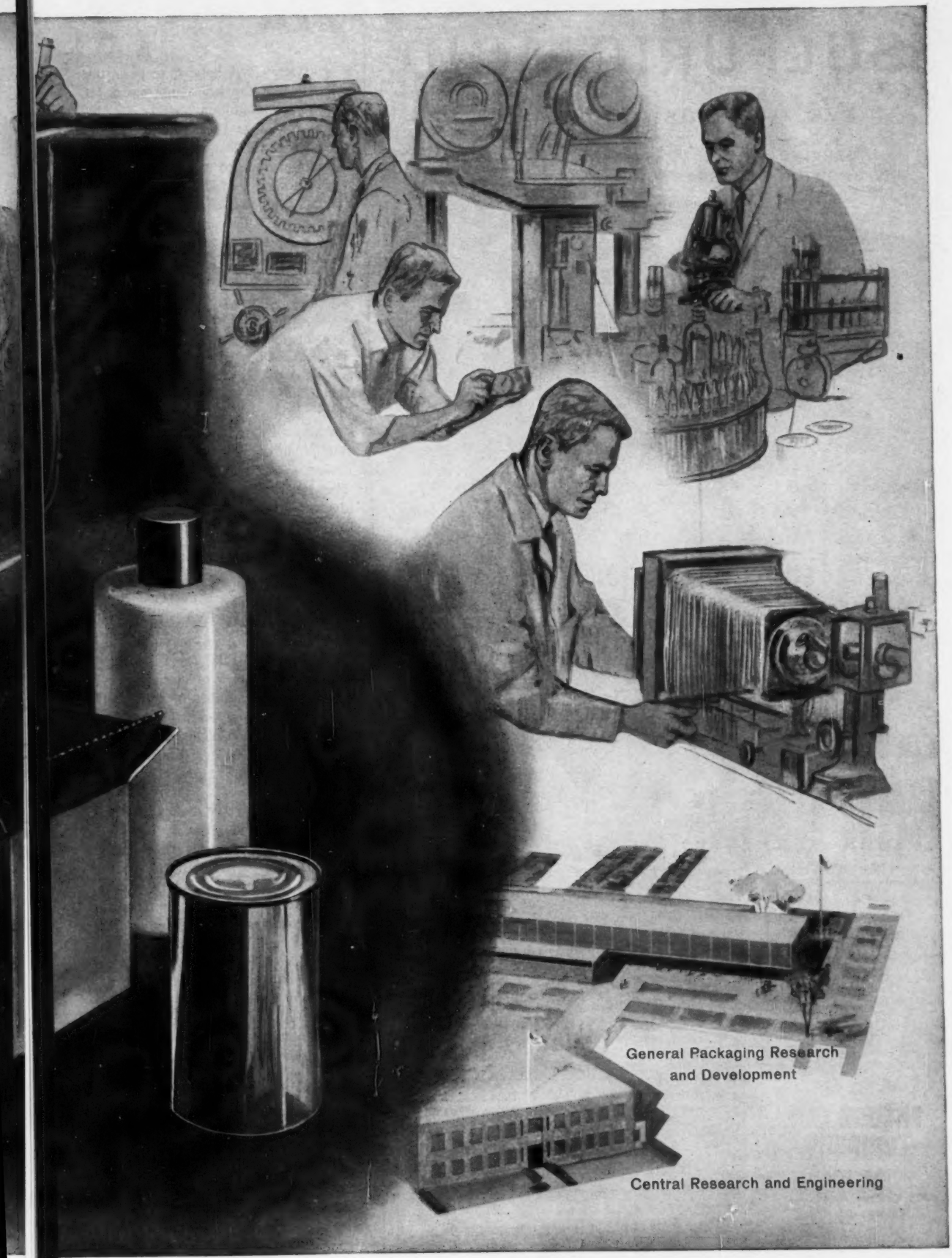
CANS • VAPOR-VACUUM® CLOSURES • FLEXIBLE PACKAGING • FIBRE DRUMS • SHIPPING CONTAINERS • STEEL CONTAINERS • PAPER CONTAINERS • PLASTIC CONTAINERS • FOLDING CARTONS • DECOWARE® • CROWNS AND CORK • BONDWARE® • HAZELWARE® • BAGS • CONOLITE® • GLASS CONTAINERS • METAL CAPS • KRAFT WRAPPINGS • BOXBOARD • CONTAINERBOARD • MULTIWALLS



Metal Research and Development

Hazel-Atlas Glass Research and Development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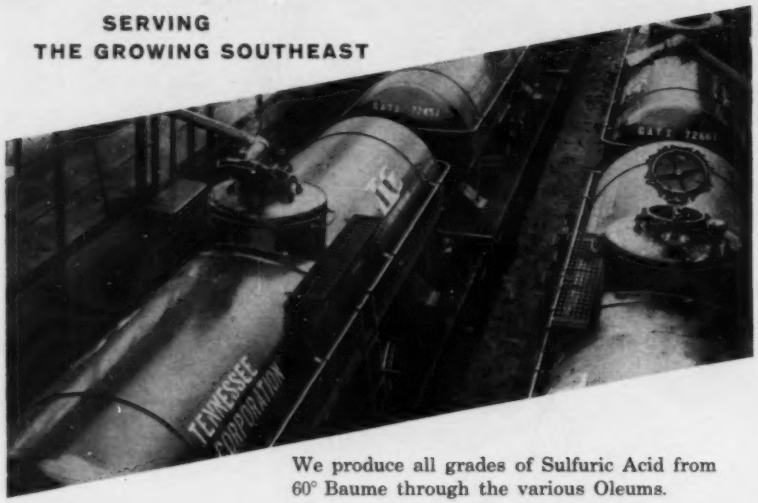

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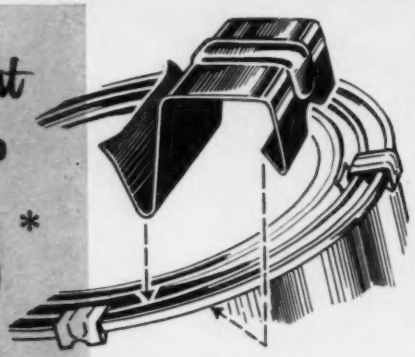

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For convincing proof--you're invited to try Freund Triple-Grip Can Clips and see for yourself. Samples, simple instructions, and low quantity prices--yours for the asking. Use your letterhead or handy coupon below.

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ATlantic 5-7700
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Chicago 53, Ill.

FREUND CAN COMPANY Date_____
4445 Cottage Grove Ave. 1
Chicago 53, Illinois
Without obligating us in any way--send us samples of Freund Triple-Grip Can Clips so we can try them.

YOUR NAME_____
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Chrysler Corp. appears to be in the forefront of the aluminum users. It has a new aluminum engine for the compact Dodge Lancer and Valiant. This added 74 lbs. to the amount of aluminum put into each of these cars, which now totals 143.5 lbs. All Chrysler cars average 69.5 lbs. of aluminum, up nearly 5 lbs. from last year in Dodge Dart models and 7.9 lbs. in Plymouths.

In addition, an aluminum engine is standard on the Oldsmobile F85, standard on some models of the Buick Special, and optional on the Pontiac Tempest. One dissenter: American Motors will not have an aluminum engine head on its six-cylinder aluminum engine as planned.

Although aluminum is making substantial inroads in new cars, magnesium is not faring nearly as well. The latter's severest defeat was its loss to Du Pont's Delrin (acetal resin) in the Valiant and Lancer instrument cluster. Zinc also lost out to plastics in some applications in the '62 models. But all the '62 cars use additional galvanized sheet metal.

Coatings Remain Constant: There is not much change in the automobile coatings picture this year. Although the further invasion of compact cars will reduce the number of gallons of paint put on each car, an average '62-model-automobile's paint needs will still be close to last year's level of 3.5-4 gal. (1.25 gal. of primer, 2.25-2.75 gal. of finish.) Again, though, increased car demand within the next year will probably hike the auto industries' total coatings requirements 22%, to 26 million gal.

All General Motors and Ford cars will continue to use a sprayed-on high-zinc primer. Unitized bodies for the Ford and Chrysler '62-models are dipped in a water-thinned latex paint. It is then washed off the exterior area. Both companies will continue to use a melamine alkyd enamel finish on their cars. General Motors, on the other hand, will continue to coat its cars with an alkyd lacquer.

Outlook: Right now, the coming year shapes up as the best on record for the sale of plastics, paint and light metals to the auto industry. But this hope is based largely on Detroit's confidence that 6.6 million U.S.-built automobiles will be sold during the next 12 months. They have been wrong.

BULLETIN:

New Shell pocket computer helps calculate the evaporation rate of a hydrocarbon solvent in minutes—can be used right at your desk

Shell has invented a handy six-inch computer that lets you calculate solvent evaporation rates at your desk. It's called the Evapo-Rater.*

Here's how it can save you time and help avoid costly trial and error experimentation.

FOR THE first time you can determine solvent evaporation rates without leaving your office.

Shell's new Evapo-Rater does the work for you.

Supplements laboratory device

For years manufacturers have been familiar with the Shell Thin Film Evaporometer—used to determine evaporation rates.

But the Evaporometer resides in laboratories. It is expensive and time-consuming to operate. And it stands about 3 feet high.

So now Shell has invented the new six-inch Evapo-Rater, shown above.

Gives answer in minutes

The new Shell Evapo-Rater is based upon hydrocarbon evaporation rates determined by the Thin Film Evaporometer. It approximates results you can obtain with an Evaporometer, and gives you an answer in a matter of minutes.

The Shell Evapo-Rater makes selection of the correct hydrocarbon solvent quicker and easier than ever. It reduces the need for extensive trial and error experimentation.

New Shell Evapo-Rater, above, determines solvent evaporation rates in minutes. Shell is offering the Evapo-Rater to help users select the correct hydrocarbon solvent.

Works for blends of solvents

And it permits you to determine the evaporation rates for *blends* of hydrocarbon solvents as well. All this can save you valuable time and money.

A limited supply of Evapo-Raters is available for solvent consumers and can be obtained from your local Shell Oil representative. Call him today.

For address of nearest Shell representative, write Shell Oil Co., 50 West 50th Street, New York, N.Y.

SHELL

A BULLETIN FROM SHELL
—where 1997 scientists are working to provide better products for industry

*Copyright 1960

Test tube on the left contains a mixture of polyvinyl acetate and hydrocarbon resin which have been hot melted together. They are obviously highly incompatible.

Test tube on the right contains the same incompatible mix, except that a quantity of Nevillac was added to the melt. They are now clearly compatible.

Nevillac® makes friends out of enemies in adhesive formulations

Among the merits of Nevillac, Neville Chemical Company's hydroxy resin, is its value as an essential ingredient in adhesive formulations. It is effectively used in several other areas in addition to adhesives. Because it is so highly compatible and soluble itself, it acts as an effective agent for bringing normally unfriendly materials together in solution. This co-compatibilizing and natural solubilizing characteristic is realized in its use with most elastomers, plasticizers, solvents and other resins. But these are not the only good reasons for using Nevillac.

Nevillac also possesses an inherent ability to increase the tack and bond of adhesives to which it has been added. It is effective in lowering the molten viscosity of adhesive formulations and it accentuates resistance to water and alkali. Other Nevillac characteristics are generally good light stability, permanent thermoplasticity and ease of emulsification. It can be appropriately used in cold cut, hot melt or latex blended formulations.

It is also used in the compounding of printing inks, lacquers, coatings, waxes, polishes and rubber, to name a few. You'll find it will pay to investigate Nevillac for your products. Write for further information.

Neville Chemical Company, Pittsburgh 25, Pa

NEVILLE®

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Resins—Coumarone-Indene, Hydrocarbon (Thermoplastic and Heat Reactive), Hydroxy • **Oils**—Plasticizing, Neutral, Rubber Reclaiming, Shingle Stain • **Solvents**—Aromatic (Refined and Crude), Semi-Aromatic (Refined and Crude). • **Antioxidants**—Non-Staining Rubber • **High Purity Indene • Indene Derivatives • Crude Naphthalene.**

Market Newsletter

CHEMICAL WEEK
October 14, 1961

More ABS resin coming to market. It has not been officially revealed, but Goodrich Chemical has just started commercial production of acrylonitrile-butadiene-styrene (ABS) resins at a new plant at its sprawling Louisville, Ky., synthetic rubber and plastic raw materials complex.

No cost or capacity data is available but the new unit probably will be capable of producing three times as much material as Goodrich's ABS plant at Akron. Capacity of the latter unit has been estimated at about 15 million lbs./year (*CW, Aug. 5, p. 111*).

Startup of the new Goodrich venture came as a surprise to the trade—ABS interest, generally, has been centered on progress at Monsanto's 40-million-lbs./year plant now under construction at Addyston, O.

The report, unconfirmed by Goodrich Chemical officials, is that the new Louisville installation will produce a "better" ABS resin as a result of some significant process improvements.

•

U. S. lithium chemicals marketers will have more competition next year as anticipated (*CW Market Newsletter, Sept. 23.*). Quebec Lithium (Montreal) confirms it will start selling lithium hydroxide monohydrate by early '62 in the U. S. and anywhere else markets can be found.

But Quebec Lithium's spokesmen say they won't try to undersell other producers—although the business admittedly is highly competitive. The firm put its lithium chemicals on the market last May and is "satisfied" with the way sales are shaping up. Most important outlets: grease and ceramics manufacture.

•

Plymouth Oil Co.'s new petrochemical plant at Texas City, Tex., has successfully come through its shakedown run and is ready for full-scale production. Annual aromatics output from the Udex extraction unit (licensed by Universal Oil Products) will be about 5 million gal. of high-purity benzene, 12 million gal. of nitration-grade toluene and 14 million gal. of mixed xylenes and ethylbenzene.

•

A ½¢/lb. price cut on technical-grade benzoic acid marks startup of Heyden Chemical's (Heyden Newport Division) new, 12-million-lbs./year plant at Garfield, N.J. The new price, 19½¢/lb. in truckloads, is attributed directly to production economies effected by the plant, which Heyden claims is the world's largest benzoic unit.

•

Celanese Polymer is raising prices of cellulose acetate molding compounds and flake 2¢ to 6¢/lb., depending on grade. Molding material tabs: translucent colors and pearls, up 4¢/lb., to 52¢/lb.; opaque colors,

up 6¢, to 46¢/lb. Cellulose acetate flake prices are up 2¢/lb. on two grades, bringing tabs to 41¢ and 46¢/lb. New prices will become effective Nov. 3.

•

A big surge in consumption of fluorinated hydrocarbons is a virtual certainty as a result of the Food & Drug Administration's approval last week of Du Pont's Freon C-318 (octafluorocyclobutane), as a propellant in aerosol food containers.

The Du Pont product will probably be used in combination with nitrous oxide to provide pressure in canned foods such as whipped cream. This mixture would replace nitrous oxide now used alone or in mixture with carbon dioxide. Food product quality improvements are expected to result from a shift to the new propellant combination.

Mixtures of Freon C-318 and nitrous oxide for use in aerosol packaging will be available immediately from Ohio Chemical and Surgical Division of Air Reduction under a marketing agreement already worked out with Du Pont's Freon Products Division. Freon C-318 alone will be available from Du Pont.

•

Dow Chemical has settled on its polystyrene pricing course. A 1¢/lb. across-the-board increase went into effect Oct. 9, putting the base price of crystal material at 19¢/lb., medium-impact polystyrene at 21¢/lb. and high-medium-impact at 23¢/lb. Volume color prices start at 21¢/lb. Just last week Dow deferred the effective date of the price hike from Oct. 1 (*CW Market Newsletter, Oct. 7*).

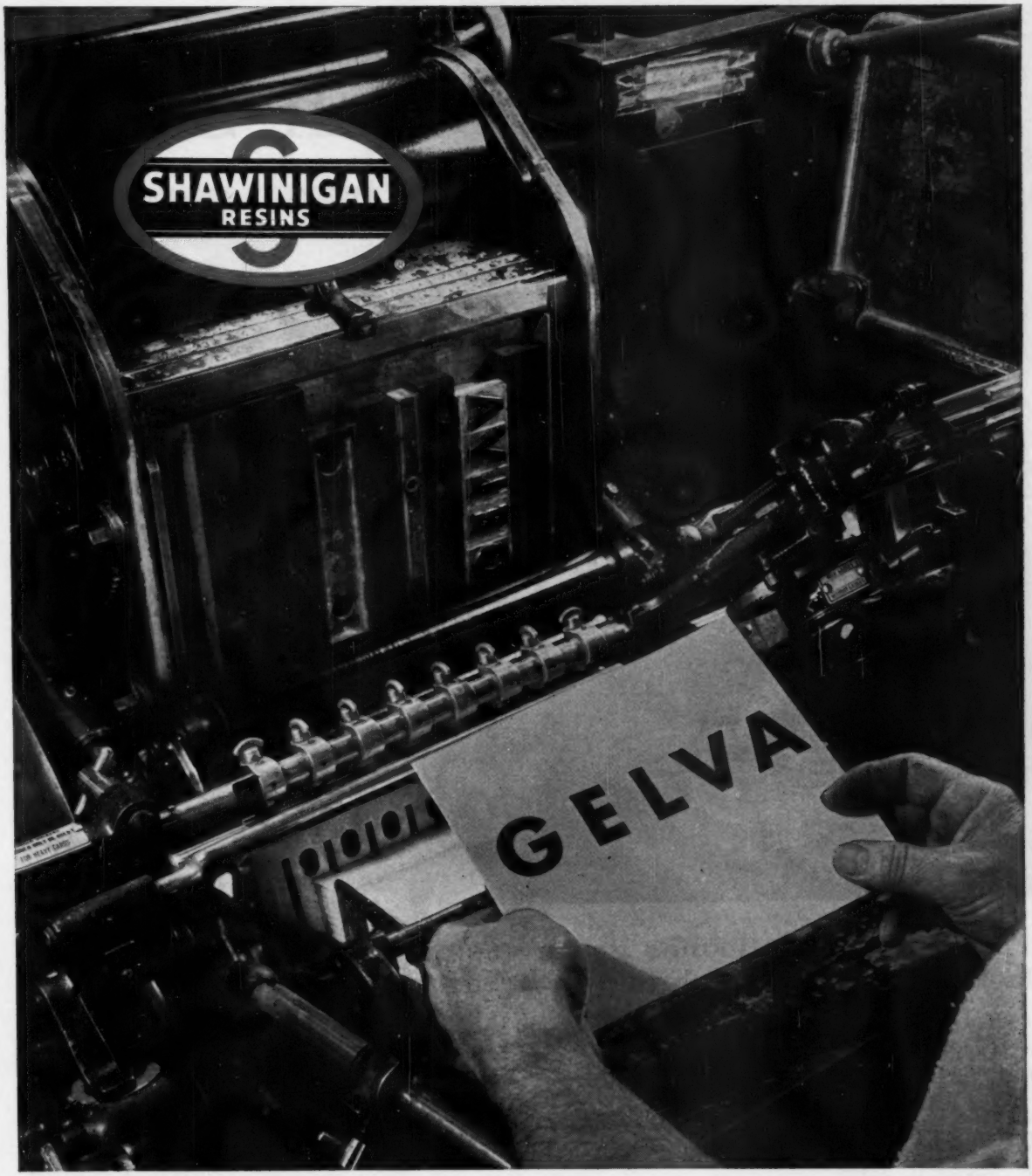
Shell Chemical is going along with the polystyrene price rise. Shell will put its 1¢/lb. increase on general-purpose and medium-impact materials into effect Nov. 1.

•

California Chemical Co.'s marketing plans for phthalic anhydride are crystallizing. The timing will be keyed to start of production (still some time off) at the East Coast plant it's building at Perth Amboy, N.J. (*CW Technology Newsletter, Aug. 12*).

When the new unit is completed, shipments to the East from the firm's Richmond, Calif., plant will cease. The Eastern plant is expected to strengthen regional marketing because of better customer service, use of captive *o*-xylene raw material, elimination of cross-country shipping costs, and the availability of a more complete line of related materials, including maleic anhydride and isophthalic.

Meanwhile, California Chemical will sharpen sales operations in the West to handle increased phthalic supplies when shipments to the East stop. For one thing, the company is considering production of plasticizers at its Anaheim, Calif., plant, and plans to distribute samples soon. Plasticizers will not, of course, take up all phthalic made by the firm in the West. Therefore the company will continue to push the product for polyesters, alkyd resins and paint applications.



GOOD PROOF. *Indeed!* Thanks to the technological advances implicit in GELVA C-3 and C-5 Copolymer Resins, this printer has obtained an easier-to-look-at, easier-to-print-on paper. Perhaps you have a problem that a vinyl derivative might solve. Put it up to Shawinigan's creative research. As specialists in polymer chemistry, we are solving problems and improving products in such varying fields as paper, textiles, pharmaceuticals, adhesives, building products, and electronics. The answer to your problem may already be in our more than 60 resins, emulsions and solutions. If it isn't, we'll be happy to custom-develop one for you. Write Department 12.

Shawinigan Resins Corporation, Springfield 1, Massachusetts

SILICONE NEWS from Dow Corning

Polish up polish sales

Polishes with silicones go on easier, last longer, increase brand preference

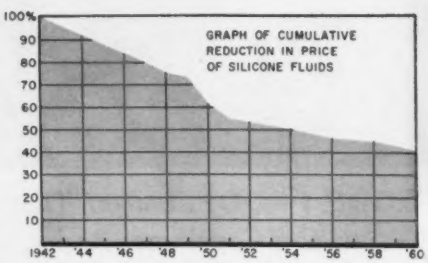
A gleaming table top, a shimmering car finish, a sparkling window... each indicates a satisfied customer. But there's more to making a polish popular than pleasing the eye. How easily does it go on? Will it resist time and weathering? Does it repel water and spotting? The right answers mean more sales. And when you have formulated your polishes with Dow Corning silicone fluids, they meet the test on every count.

Ease of application is a real customer pleaser, a time-saver they remember the next time they buy. With silicones in your polish, application is speedy; less rub-out is required. The polish spreads easier, resulting in faster formation of a better film.

Greater durability and beauty result from silicone formulation, too. No other ingredient can provide the same degree of oxidation resistance and water repellency . . . which means longer lasting beauty and protection for furniture, autos, glass and appliances.

You can get quick help in improving existing products or in readying new polishes for the market by drawing on the vast fund of data our chemists have compiled on the uses of silicones in polishes.

One final note to remember: people now recognize the better looking, more durable protection silicones provide. Take advantage of this growing awareness by putting "silicones" on the label. It will help polish up your polish sales.



Silicone fluids have shown a steady decrease in price while many of your costs have constantly increased.

Contact Dow Corning Corporation, Dept. 2822b, Midland, Michigan, for technical data or formulating recommendations on the use of silicones for finer polishes.

first in silicones

Dow Corning

Tough Tests for New Filter Fabric

This week, the Amflex Products Dept. of American Machine and Foundry Co. (Springdale, Conn.) is running final tests (right) for the first commercial application of a new cartridge filter material, Fiberfilm, designed for high-temperature, corrosive service. The new filter media, a nonwoven, ultrafine glass fiber impregnated with silicone resins, is the newest of a raft of materials offered for the growing, 400 F filtration field —already an estimated $12-million/-year market.

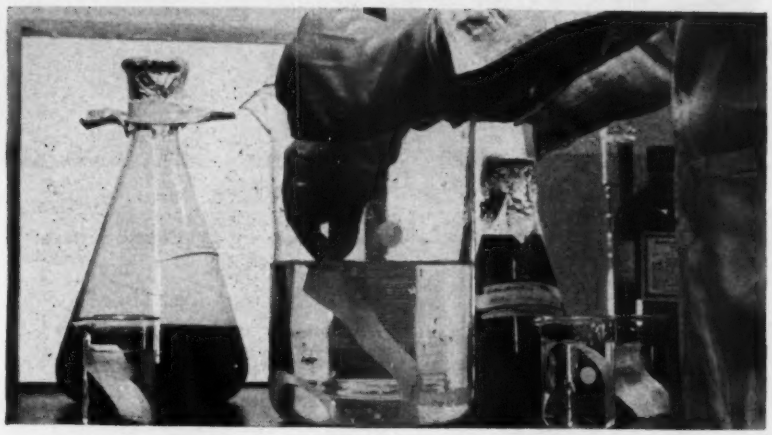
Fiberfilm faces tough competition from potent rivals, old and new. Among the more recent products are ceramics, such as Carborundum Co.'s (Niagara Falls) Fiberfrax, National Carbon Co.'s (New York) graphite, AMF's still-in-lab quartz. In addition, there are other combination materials, including a Teflon-impregnated form of Fiberfilm, and AMF's Teflon-reinforced woven glass, tagged Amfab.

And currently taking the lion's share of the high-temperature filtration business are such "old-timers" as glass (with various treatments), asbestos, specialty metals and Teflon itself.

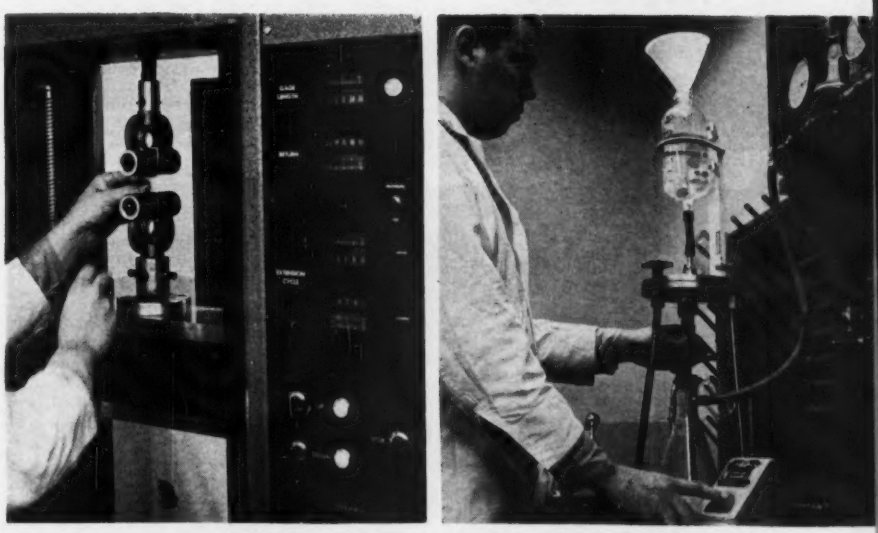
The list of media is now long enough to give management a broad choice—but costs of the newer materials are discouragingly high. And, despite the steadily increasing size of the market, the prospect of lower prices seems poor.

Three Hot Jobs: Today's high-temperature filter market is heavily based on three major filtration areas: cleanup filters (e.g., the cleanup of polymers for synthetic fiber production; because of their viscosity, these resins must be filtered at the plus 400 F range); solids-liquid separations (e.g., plate and frame or rotary drum filters); solids-gas separations (e.g., bag

HEAT AMF lab technician checks weight loss of Fiberfilm in an oven to test the new material's relative resistance to high temperatures.



CORROSION AMF's Amfab is soaked in corrosive chemicals to determine its resistance at various conditions.



STRENGTH Fiberfilm is shown here going through two important tests—tensile strength (left) and porosity (right).

JOHNS-MANVILLE decides on Entoleter

Impact Mills

E. C. Truax, Manager of Johns-Manville's Nashua plant, says Entoleter Impact Mill is the only machine that can do all three jobs in the preparation of asbestos cement-board: *Fiberizing* of ore, *reduction* of agglomerates, and thorough smooth *blending* of asbestos fiber, cement and pigment.

The principle of the Centrifugal Impact Mill (high-energy centrifugal force plus shattering impact) is used by many manufacturers for controlled *particle-size reductions,* and for *elimination of agglomerates* and for *fast blending* of ingredients into a smooth-textured, homogenous mixture of dependably consistent quality.

The high efficiency and the low H.P. requirement of the Entoleter Impact Mill make it highly desirable in processing for *mixing, grinding,* and the intimate *dispersion* of trace ingredients.

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filters for atmospheric pollution abatement).

AMF's Fiberfilm is being groomed carefully for entry in the cleanup filter field. Originally developed over two years ago (*CW, Sept. 26, '59, p. 96*), the material has undergone much testing and refinement, and now has greater tensile strength, flexibility, and longer life, says Joseph G. Adiletta, general manager of AMF's Amflex Products Dept. Aiming at the chemical market, AMF already has a prototype version Fiberfilm (SD-120C-50), in a pipe-threaded cartridge filter, cleaning up the impurities on a chemical final product line.

Fiberfilm is primarily designed for the cleanup filter field, is unlikely to make much headway in the solids-liquid separation or the bag filter area. Reason: the material is high-priced—$3.50-4.50/sq.yd., compared with 55¢-$7/sq.yd. for glass, the big seller.

On the other hand, cost compares favorably with that of porous metal, however, for cleanup filter use. Furthermore, AMF claims, it lasts longer than metals.

Another product AMF suggests for use instead of fine-mesh wire screens and possibly Teflon and glass is Amfab (TV-20-30). The main application here would be in solids-liquid separations at high temperature. The new material is being tested right now by one chemical company for critical filtrations in place of 325-mesh screen. It is being used under conditions of high acidity and pressure. Amfab is a woven glass fabric coated with Teflon to a controlled porosity.

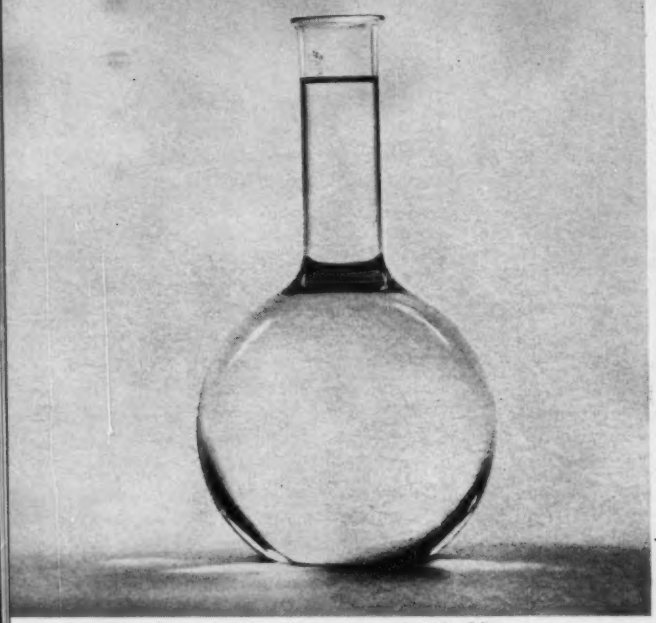
This material costs roughly the same as Fiberfilm but is competitive in cost with unsupported Teflon or a woven wire such as Monel or stainless steel.

Amfab shares the high corrosion resistance of Teflon, of course, and has its temperature limitations: at about 500 F, the Teflon starts to be removed by the filtrate.

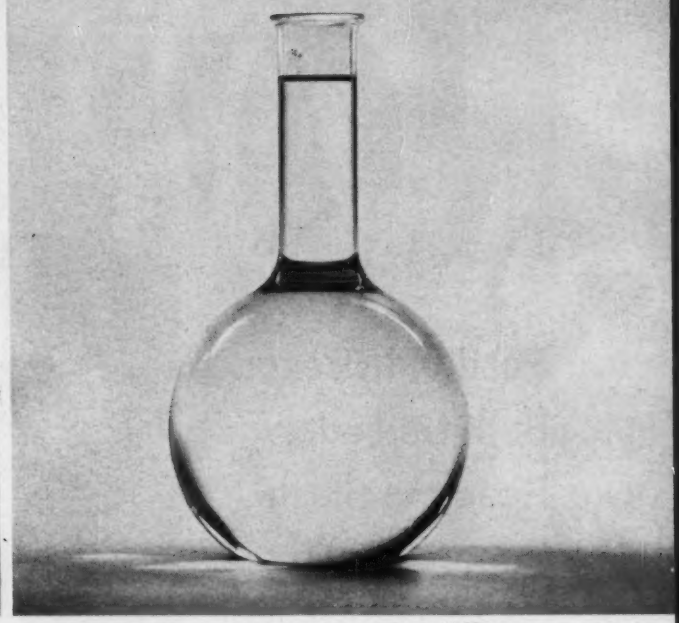
It is unlikely that Amfab will compete strongly with glass in filter bag operations where the latter is more than 50% cheaper.

Ceramics Growing: The use of ceramic fibers for high-temperature filtration is a fast growing trend. Carborundum reports that total sales of Fiberfrax have exceeded the $1 million/-year mark. The filtration segment of

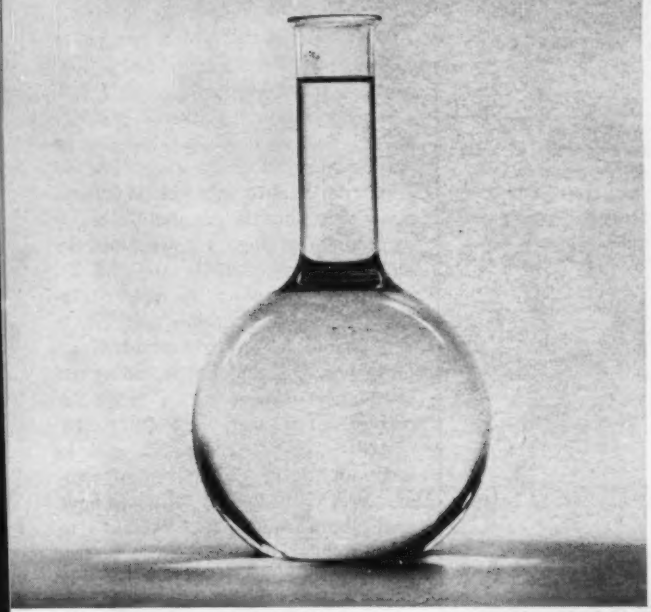
FA 3 after ASTM heat test: Gardner Color 4.



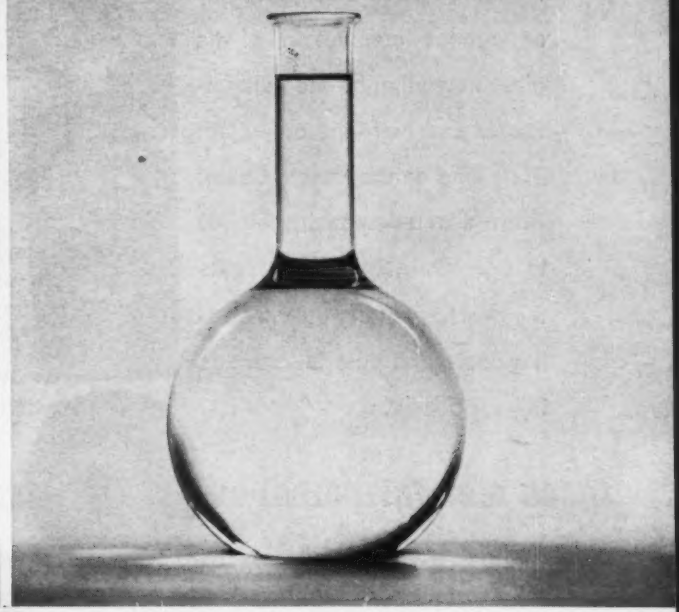
Long oil alkyd with FA 3: Gardner Color 3.



Medium oil alkyd with FA 3: Gardner Color 3 minus.



Short oil alkyd with FA 3: Gardner Color 3 minus.



New Acintol FA 3 starts light, stays light! It's the lightest, most color stable fatty acid for the price!

Laboratory tests prove it. Arizona's ACINTOL® FA 3 fatty acid consistently produces lighter color alkyd resin vehicles than competitive products at comparable prices. What's more, ASTM and AOCS color stability tests show after heating that ACINTOL FA 3 is the lightest color fatty acid at its price.

In addition to extreme lightness and superior color stability, ACINTOL FA 3 offers low unsaponifiables and low rosin acid content.

For substantiation of the above statements, send for technical service laboratory reports and data sheets. Write Arizona Chemical Company, 30 Rockefeller Plaza, New York 20, N. Y.

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- direct transfer from ship to rail or truck
- 140-car rail yard
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that sales figure, however, is small. This is primarily because of its high price—up to 10 times that of glass.

Fiberfrax's main recommendation for chemical use is in the cleanup filter field at very high temperatures (exceeding 1000 F).

Fiberfrax filter material consists of long staple aluminum silica woven fibers. It is resistant to acids at temperatures up to 2300 F.

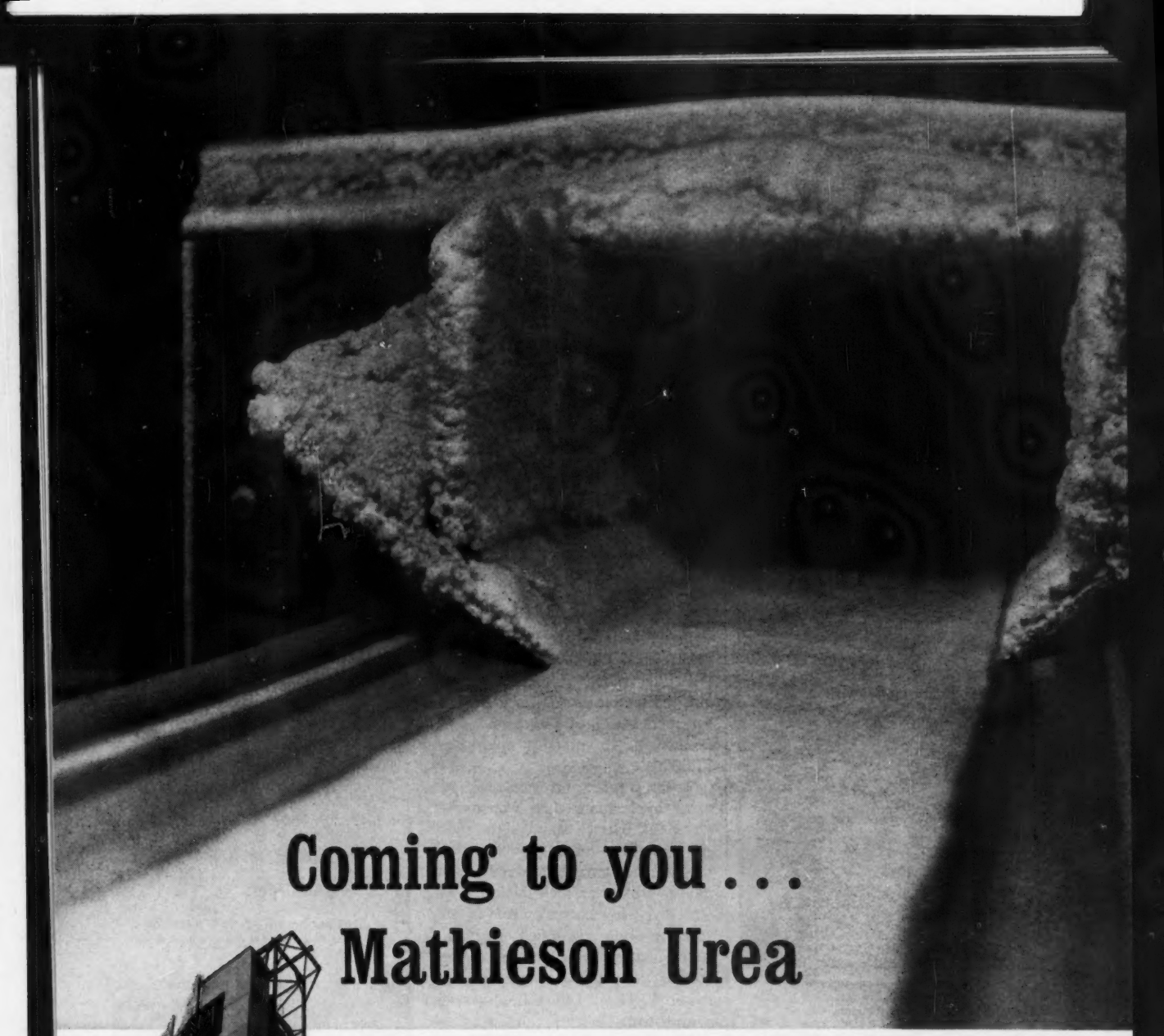
Filter elements made with it are claimed to be serviceable at higher temperatures and under more corrosive conditions than any other fibrous material. One tough application: a chemical company uses it to remove impurities from hot nitric acid. This is generally done by less-expensive (but less-corrosion-resistant porous metals). Carborundum admits, however, that for temperatures less than 1000 F, cheaper materials (e.g., glass) are a better choice.

Another ceramic which can go to high temperatures if necessary—and is even more expensive than Fiberfrax—is National Carbon's graphite fabric. It too, is designed primarily for cleanup filter use; it appears too fragile for bags or solids-liquid separation. This unusual material increases in strength at high temperatures (its tensile strength doubles at 3000 F). Although it is subject to rapid oxidation in high-temperature air, it is very stable in an oxidation-free atmosphere. This material is finding use in molten metal filtration (e.g., the processing of high-purity titanium).

AMF's all-quartz ceramic, still in laboratory stage, is capable of temperatures up to 2000 F. It could have applications similar to Fiberfrax's in cleanup filter use. AMF has no estimate of its price but it will likely be as much as that of Fiberfrax.

Glass Stands Out: At present, glass fabric is the most widely used high-temperature filter fabric, primarily in solids-gas separation (e.g., bag houses for separation of carbon black, gypsum or cement from their processing gases, and in air pollution abatement). Owens-Corning Fiberglas Corp. (New York) appears to be the leading producer of this material.

It now looks as if the new fabrics will have a hard time displacing glass in these applications, mainly because of glass's comparatively low cost. Most bag houses require several thousand square yards of fabrics,



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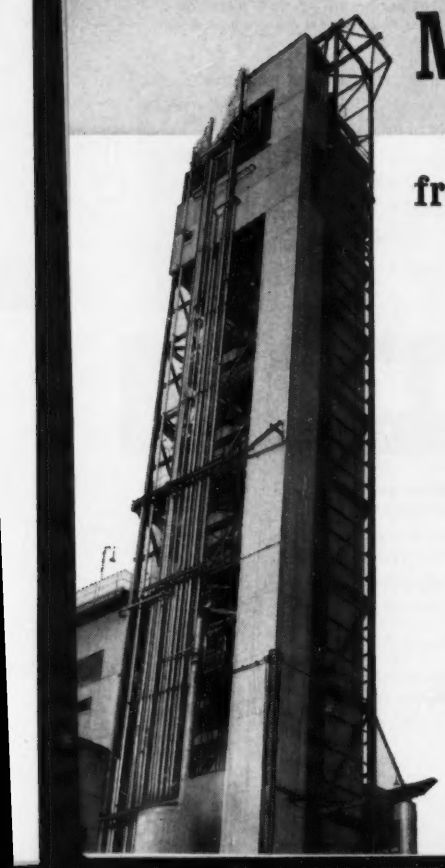

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and use of even the lowest-cost glass requires considerable investment.

Furthermore, glass fabrics have been improved in recent years with the addition of silicone to help remove the solids. Glass is not used as widely in solids-liquid separation because of its relatively low tensile strength. It can't stand the stretch and strain imposed, for example, by a continuous rotary drum filter or a plate and frame type.

Right now, unsupported Teflon (as differentiated from Teflon-impregnated fabrics) is competing with metal screens in corrosive chemical service. It is far more widely used here than in solids-gas separation.

It has been difficult to convince users of the superiorities of Teflon, says Roger Flaherty, co-owner of Flaherty - Kennedy Filter Fabrics (Maplewood, N.J.). Users expect free test filters, but, as Flaherty points out, the sample panels for a five-panel rotary drum filter 36 ft. in circumference and 40 in. wide would be over $1,000.

Teflon is more corrosion resistant in many applications than woven metal screens of Monel, stainless, or nickel. As one filter expert puts it, fine-mesh metal screens are only a few thousandths of an inch thick and even a relatively low corrosion rate (1 mil/-year) is often too much. Further, it is frequently difficult to install metal screens, particularly where brazing is required. Thus, Teflon becomes very competitive.

Metal filter screens will, however, remain an important high-temperature filter media because of their durability, high tensile strength and good corrosion resistance in specific chemical applications.

While metals are undoubtedly holding their own with the new materials, asbestos as a filter material, appears on the decline. Reason: the short asbestos fibers are difficult to weave into a strong fabric. Often, other, stronger fibers (such as cotton) are woven in with the asbestos to increase its strength but this lowers the temperature limit.

Despite their drawbacks, these new materials have much to offer. And as experience with them builds up, ways to use them profitably will multiply. Certainly, as chemical processing conditions become more stringent, the need for them will grow apace.

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U.S.I. CHEMICAL NEWS

October | A Series of Advertisements for the Chemical Process Industries | 1961

System for Purifying and Metering Sodium Proved in Three Years' Operation

A pilot plant that provides sodium metering accuracy as well as efficient sodium purification has been developed by U.S.I. This pilot plant unit, designed to demonstrate the ease with which sodium may be handled, has given satisfactory performance in three years of operation at U.S.I.'s Cincinnati, Ohio, Research Center.

The system provides accurate metering of the sodium while maintaining the necessary low oxide content. Equally as important is the simplicity of design and the ease of operation that permit shift personnel to operate the unit.

A 300-gallon sodium storage tank supplies the system, which is blanketed with nitrogen. Molten sodium is pumped through a micrometallic filter at 220-230°F, the temperature at which calcium and sodium oxides are removed. Purified sodium then goes to metering tanks.

Primary and secondary tanks are provided to insure a uniform supply of so-

(Continued on next page)

Murray Named Manager of U.S.I. Minneapolis District

John N. Murray has been named Minneapolis District Sales Manager for U.S.I. He replaces William J. Brett, who has retired.

John N. Murray

William J. Brett

Mr. Murray joined U.S.I. after graduation as a chemical engineer from the University of Illinois in 1955, and shortly thereafter served two years in the U.S. Army. Since 1957, he has been with U.S.I.'s Minneapolis Sales District. Mr. Murray is a member of the National Credentials Committee of the Society of Plastics Engineers and is on the Board of Directors of the Twin Cities Chemical and Allied Trades Association.

Mr. Brett was manager of the U.S.I. Minneapolis Sales District since 1935. He will continue to represent U.S.I. in sales of sodium peroxide to the paper industry.

Complete Information on Ethyl Ether Presented in New Booklet

First Collection of Latest Specs for Major Grades of Ethyl Ether Included in Comprehensive, 46-Page U.S.I. Publication

A new booklet on Ethyl Ether, edited by U.S.I.'s technical service engineers, has just been published. Comprehensive and practical, the new brochure contains complete information on chemical, physical and physiological properties of ether as well as latest specifications and test procedures, and shipping, storage and handling data.

The booklet presents the first collection of current specifications for the three major grades of ethyl ether—including the new specifications for ethyl ether ACS absolute, recently published by the American Chemical Society. The new ACS absolute specs are presented along with those for Technical Refined and U.S.P. grades in a table that is indexed for easy reference to complete test methods that are given in the pages immediately following. U.S.I. is a leading marketer of all three grades, and has recently started up a new refining unit that produces ethyl ether meeting the new, more stringent ACS specs.

Technical Service Program

The sections in the new booklet on unloading and handling and storage present a detailed summary of the knowledge U.S.I. has accumulated in 35 years of providing such information to customers through its technical service program. The

(Continued on next page)

Tank Trucks Preferred for Mixed Solvent Shipments

Solvent users are swinging to tank truck shipments in preference to receiving deliveries in tankcars or drums. According to U.S.I.'s traffic records, tank truck shipments have increased from 38% of total solvent deliveries in 1958 to 52% for the first four months of this year. In the same period, tankcar deliveries have dipped from 36% to 33% of total solvent shipments, and drum shipments are down from 19% to 12%.

Major reasons for this trend are the speed of delivery possible by tank truck from distribution centers in strategic cities and the convenience and economy of ordering such solvents as butanol, acetone, n-butyl acetate and ethyl acetate in combination truck loads with U.S.I. specially denatured ethyl alcohol or SOLOX® and FILMEX® proprietary solvents. Solvent users get prompt delivery on combination tank truck shipments tailored to their needs, realizing savings in inventory and shipping costs as well as in delivery time.

SPECIFICATION	TECHNICAL REFINED		A.C.S. ABSOLUTE		U.S.P. XVI	
	limit	procedure	limit	procedure	limit	procedure
Maximum Specific Gravity	0.718 @ 20/20°C 0.713 @ 25/25°C	1b	no specification		0.716 @ 25/25°C	1c
Minimum Specific Gravity	0.712 @ 20/20°C 0.710 @ 25/25°C	1b	no specification		0.713 @ 25/25°C	1c
Maximum Density	no specification		0.7079 @ 25°C	1b	no specification	
Acidity, as Acetic Acid	0.0025%, by weight maximum	2a	0.001%, by weight maximum	2b	passes test	2c
Non Volatile Matter	0.002%, by weight maximum	3a	0.0010%, by weight maximum	3b	0.003%, by weight maximum	3c
Peroxides	passes test	4a	0.0001%, by weight maximum	4b	passes test	4a
Chlorides	passes test	5	no specification		no specification	
Aldehydes	passes test	6a	0.0005%, by weight maximum	6b	passes test	6a
Alcohol	0.5%, by volume maximum	7	passes test	7a	no specification	
Water	0.3%, by weight maximum	8a	0.01%, by weight maximum	8b	no specification	
Odor	non-residual	9	passes test (limit about 0.05%, by weight maximum)	9	passes test	9
Color	water-white	10a	no specification		colorless	10b
Substances Darkened by Sulfuric Acid	no specification		passes test	11	no specification	
Packaging	no specification		no specification		as directed	12

Table of latest ethyl ether specifications from U.S.I.'s new, comprehensive booklet.

Green Polyethylene Film Gives Improved Protection As Cover for Silos

A new green polyethylene film is being used by farmers as the latest refinement in horizontal silo covers. The 7-mil-thick film is said to be a great improvement over paper, sawdust, wheat, oats, and even black pigmented polyethylene film as a protective cover for trench and bunker silos. Used in this way, it helps provide better silage storage conditions at a fraction of the cost of upright silos.

Grease-proof, shrink-proof and resistant to chemicals, temperature and humidity, the covers use eye-pleasing green pigmentation to help ward off harmful ultraviolet sun rays. The covers' thickness provides strength for serviceability and long life (up to three years in normal use).

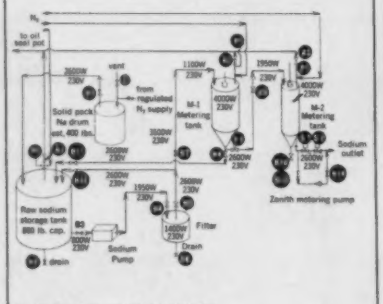
The 7-mil polyethylene film provides the farmer with the right type of material to guard against oxygen attack on silage nutrients and still allow for escape of excess gases which form under the cover during the storage period. U.S.I.'s PETROTHENE® polyethylene resin is used in the production of the covers. This green film is also being used in ice rink liners and swimming pool covers.

Purifying and Metering Sodium

(Continued)

dium to process. Metering is by gravity or pump, depending on the process pressure developed by the particular reaction involved.

Complete details on design and operating procedures are given in a new U.S.I. bulletin, "Sodium Purification and Metering." Copies are available from Technical Literature Dept., U.S.I. Chemical News, 99 Park Ave., New York 16, N. Y.



1 All pipe lines are Sch 40, black iron.
2 All valves in sodium lines are flanged bellows seal type.
3 All N_2 handling valves are needle type.
4 Graduated stick mounted parallel with the level probe not shown.
5 1½" hi temp and 1½" 80% magnesia insulation on all lines.
6 All fittings are weld type.
7 Lines have a connected power input of 360 watts/foot.
8 Sodium drum heated by 3 - 3000 W band heaters.

A Designates N. vent valves
B Designates bellows seal sodium valves
C Back pressure regulating valves
S Solenoid valves

Sodium metering system for pilot plants.

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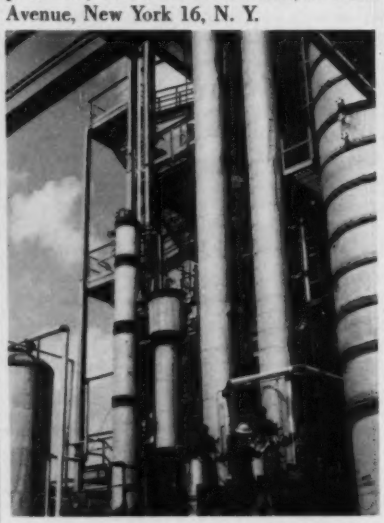
Ethyl Ether Booklet *(Continued)*

recommended procedures and precautions in the booklet are intended to serve as a guide to both bulk and drum users of ether. As in the past, U.S.I.'s trained technical service men are available to assist in specific problems as the need arises.

The section on physiological properties contains detailed instructions on safety precautions, protection of personnel and first aid procedures.

A bibliography is provided for those seeking information on any aspect of ethyl ether use beyond the scope of the booklet.

For your personal copy of "U.S.I. Ethyl Ether," write to Technical Literature Department, U.S.I. Chemical News, 99 Park Avenue, New York 16, N. Y.



New U.S.I. ethyl ether refining unit at Tuscola, Illinois.

ACS Announces New Journal On Inorganic Chemistry

The American Chemical Society will start publication of a new basic journal, "Inorganic Chemistry," in February, 1962. It will be issued initially as a quarterly with 200 pages per issue.

The journal will provide a concentration of papers ranging throughout the inorganic field from the borders of organic chemistry to the borders of theoretical physics. Key criterion is that papers be related in general terms to active research areas of inorganic chemistry.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

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Benzoyl formic acid (phenyl glyoxylic acid) and methyl benzoyl formate are now available in development quantities. Suggested uses are as intermediates for pharmaceutical, veterinary and agricultural chemicals. **No. 1761**

Heat transfer symposium papers are now being sold in paper-bound, 300-page book. Covers latest advances in heat transfer as presented in 30 A.I.Ch.E. papers, along with discussions of a number of the papers. **No. 1762**

New marketing service for rubber and plastics industries will provide abstracts of material from over 200 prime marketing sources. Designed to supply information needed by market researchers in the polymer industries. **No. 1763**

Special-purpose slide rules and calculators save time and eliminate steps in solving problems. Being sold are solution concentration and gas law slide rule, pH calculator, chemical predictor, universal kit for special designs. **No. 1764**

New nitrile-containing silicone fluids, recently introduced as experimental materials, are described in a new technical bulletin. Publication gives typical properties of available grades as well as some suggested uses. **No. 1765**

Nine ultra-high purity metals (99.999+% pure) are now being produced on a commercial scale—antimony, arsenic, bismuth, cadmium, gold, indium, selenium, silver and tellurium. For use in electronics and thermoelectric devices. **No. 1766**

Interchangeable respiratory protection provided with one facepiece and a variety of filters and chemical cartridges is described in a new bulletin. Used against such airborne hazards as dust, organic vapors, acid gases, and metal fumes. **No. 1767**

Resistances of various acid-proof cements to over 75 corrosive chemicals at 75°F and 140°F are presented in chart form in new bulletin. Useful as a guide in selecting proper cement for corrosion-proof installations. **No. 1768**

Organo-metallic compounds are the subject of a new book bringing up to date and expanding a 1956 monograph. Covers: alkali metals; Group II; Group III; Group IV; antimony and bismuth; and transition elements. **No. 1769**

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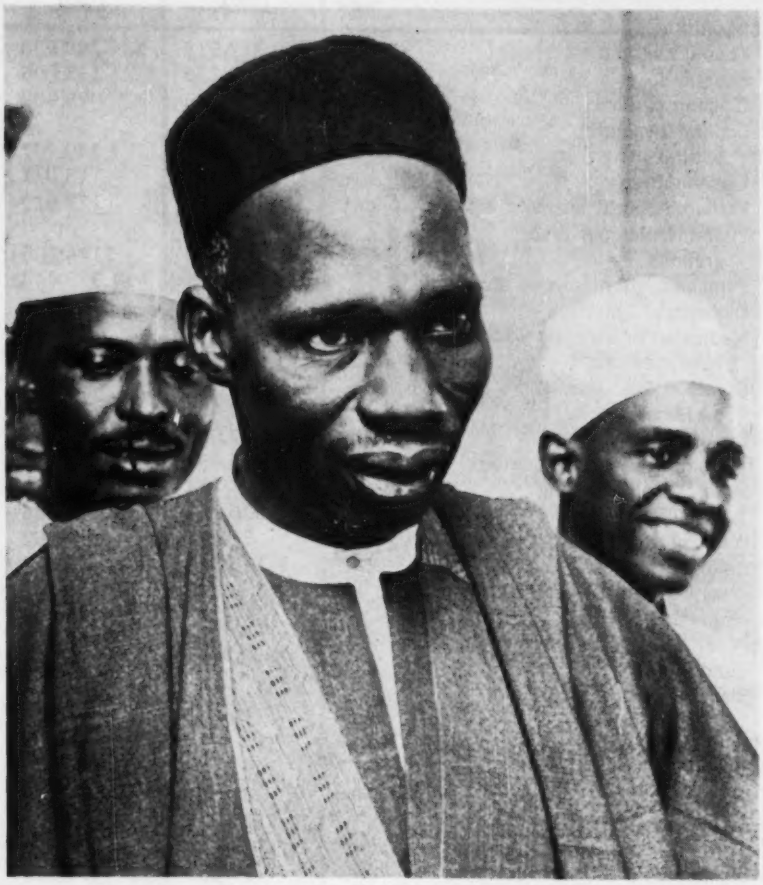

Western-oriented Prime Minister Abubakar woos private investment.

Nigeria: Perilous Suitor

One year after reaching independence, Nigeria still shines as the most promising country in tropical Africa for expanding exports and investment. But U.S. chemical companies lured by this promise are finding the Nigerian market a hard nut to crack.

For most chemical products, Nigeria is in much too primitive a stage of industrialization to support local production. And trying to reach the market through exports is often a frustrating experience. Although Nigeria's chemical imports rose 256% between '54 and '60, the U.S. share has remained only a sliver. Last year U.S. firms supplied only $558,824 out of Nigeria's total chemical imports of $34.2 million. This country sold far more chemicals to other African countries—e.g., the Congo and even tiny Liberia—than it did to Nigeria.

But Nigeria's great potential keeps U.S. companies interested. Its population of about 37 million—the biggest and most dense in Africa—includes about one-seventh of all the people in Africa. Although per-capita income is only about $100, there is still a big market for many products, and there are many factors that point to substantial growth.

Mineral wealth is one of them. Oil production began in '57. Output is now about 20,000 bbls./day, will soon be increased to 60,000 bbls./day, and is expected to reach 100,000 bbls./day by '65 and 280,000 by the '70s. Royal Dutch/Shell, British Petroleum and Socony Mobil Oil are the main operators. By '64, the Shell-BP subsidiary, B.P.-Shell Petroleum Refining Co. of Nigeria, expects to have its $33.6-million refinery on-stream at Port Harcourt.

Nigeria is the only coal producer in West Africa, and it has iron ore deposits. After extensive studies—sponsored by the Rockefeller Brothers Fund—Koppers, Westinghouse and United Engineering & Foundry Co. last month formed Nigeria Steel Associates as a step toward building a proposed integrated iron and steel complex. Negotiations with the government are reportedly in advanced stages.

It's also a substantial producer of tin. A Portugese group, Nigerian Embel Tin Smelting Co., began operating the first smelter in March, and Consolidated Tin expects to start up its smelter next month. Columbite is also produced, and exploitation of lead and zinc deposits is beginning. There are also known deposits of lignite and limestone, and natural gas will likely become an important energy source.

Right now, agriculture is Nigeria's main industry. Exports of palm products, cocoa and peanuts and other agricultural products have provided the financial reserves on which the government is now drawing for its economic development. There is a lot of room for increasing this export income as well as diversifying production and cutting down food imports.

On top of these natural assets, Nigeria's political situation is reasonably stable and its outlook is relatively bright in stormy Africa. By African standards, at least, a sturdy democracy seems to be developing. The strong sense of rivalry between the three regions and the frictions generated by their tribal, religious and cultural differences have been kept in workable bounds by the government's federation setup and the regional leaders' sense of interdependence.

"Stability," of course, is a relative thing in Africa, even in Nigeria, as the pro-Lumumba riots in Lagos earlier this year showed. Despite harmonious race relations, there is a residue of colonial resentment and antiwhite prejudice. And the seeds of trouble lie in prevalence of disease and poverty. Yet, U.S. officials in Washington and on the scene in Lagos insist that Nigeria is Africa's "shining

light," that its stability will probably continue.

Moreover, Nigeria is run by a conservative, pro-Western government, headed by the highly respected Alhaji Sir Abubakar Tafawa Balewa (*picture, p. 135*), and all three regions are ardently wooing foreign investors. They have publicly rejected nationalization of private businesses, are firm believers in private enterprise for all industries except basic utilities, although the regional governments frequently like to take a minority share in new enterprises.

To attract foreign investors, the federal government, through the regional governments, offers such incentives as tax holidays of up to five years for specified "pioneer" industries, rebates on raw-material import duties, etc.

Consumer Market: For the chemical industry, investments will be largely limited to consumer products until Nigeria's industrial development is much more advanced. Right now, industry is still marginal in the economy, contributes less than 5% to national income. It consists mainly of small plants making palm oil, soap, plywood, beer, asbestos, cement, etc. But steady progress is being made.

Michelin is completing Nigeria's first tire plant, and Dunlop has plans for another one. Two glassworks have been planned. A steel rolling mill is being built near Enugu, capital of the Eastern region, and Aluminium Ltd., plans to put up a sizable aluminum rolling mill at Port Harcourt. A textile mill, another asbestos plant, a sugar mill, and a number of other projects are actually in the works, and others are being considered—e.g., battery and plastic products plants, and a transistor radio assembly factory.

As these and other projects get under way, the market for industrial chemical products will increase. But for now the chemical business is mostly in finished products.

Cosmetics, for example, already are finding a substantial market. Six companies produce and package cosmetics—perfumes, face powder, talcum powder, pomades, brilliantines. Rose Morgan (New York) is a partner in one of these ventures. Last year value of monthly imports of hair preparations, shampoos, soaps, face creams, toiletries and powders averaged $191,000, up 28% over the '59 figure.

For potential investors in the cosmetics industry, the immediate market possibilities are balanced, to some extent at least, by the fact that they cannot expect any government financial assistance—or enthusiasm—over new cosmetics ventures. It's considered a "nonessential" industry.

Soap is another big market. Lever Brothers is the largest of four local producers, which make about 40% of the hard soaps used in the country. Much of the rest is made in cottage-scale industries. The market for more-sophisticated imported brands is limited.

With disease one of Nigeria's major problems, pharmaceuticals are one of the most promising areas, especially broad-spectrum antibiotics and vitamins. The annual market is now $19.6 million, primarily in proprietary brands. German, Danish and British companies each have ethical-drug packaging plants, and Pfizer is opening a tetracycline packaging plant in Aba this fall. It will finish raw materials imported from the U.K. So far, Pfizer is the only U.S. drug company with a Nigerian plant. (Pfizer started its Nigerian sales operations in '57, now has a force of 20.) Other U.S. companies are selling through their U.K. affiliates: Parke-Davis, American Cyanamid, Upjohn, Warner-Lambert, Evans, Eli Lilly and Wyeth. Altogether, there are 26 major importers of ethical drugs.

Basic drug production won't be feasible until there is a local chemical industry, unless local raw materials

Nigeria's Principal Chemical Imports

	Unit	1959	1960
Chemicals, total		$28,312,973	$34,248,530
Caustic soda	cwt.	92,296	115,096
Calcium carbide	cwt.	31,746	28,907
Coal-tar dyestuffs, natural indigo, etc.	lb.	1,205,077	1,340,207
Washing blue	cwt.	11,993	15,077
Prepared paints, enamels, etc.	cwt.	100,278	127,619
Vitamins, vitamin preparations		$85,610	$144,365
Penicillin, streptomycin, etc.		$1,371,625	$1,379,448
Ointments, liniments		$1,547,672	$2,107,395
Medicated or asceptic wadding, bandages, etc.		$487,421	$603,568
Essential oils, synthetic perfumes, etc.	lb.	682,452	781,523
Dentifrices	lb.	147,032	224,361
Talcum and dusting powders	lb.	856,456	809,398
Toilet soap, including medicated soap	lb.	1,936,261	1,968,086
Washing soap, soap powders	cwt.	32,875	9,062
Detergents	cwt.	6,345	26,008
Waxes, polishes, pastes, etc.	lb.	2,818,049	2,297,878
Ammonium sulfate	ton	567	878
Other nitrogen fertilizers	ton	28	842
Gunpowder	cwt.	6,882	6,546
Blasting explosives, other than gunpowder	cwt.	8,051	18,208
Hunting or sporting ammunition		$127,534	$217,101
Fuses, primers, detonators, percussion caps	lb.	352,010	203,666
Pyrotechnical articles		$175,941	$245,308
Synthetic plastic materials	cwt.	3,673	12,700
Disinfectants	cwt.	16,631	18,509
Insecticides, fungicides, etc.		$1,632,229	$2,814,101
(Exchange rate: 1 Nigerian pound = $2.80)			

can be used. The federal government has earmarked $8,400 to study local raw materials for this purpose, and Pfizer is considering opening a research unit to study possible use of local herbs.

A paint industry is also getting started. Britain's International Paints is building a plant in Ikeja (outside Lagos) for enamels, marine paints, and compositions, and Imperial Chemical Industries is spending $1.4 million on two plants at Ikeja—a paint-making unit and a plant to produce agricultural chemicals.

A few other specialty chemicals are also being made or packaged: Shell is packing insecticides; some textile mills make their own dyes; and there is a small floor polish plant in Lagos.

The only industrial chemicals produced are small amounts of industrial gases.

Last January a Federation of British Industries mission toured Nigeria, pointed out some possibilities for chemical industry investment. Agriculture, it noted, is potentially a very large customer for chemicals. But right now fertilizer consumption is only a few thousand tons, and it will take a lot of research and promotion to boost consumption enough to make a plant worthwhile. Nigerian oil or gas could provide some of the raw materials, the mission noted, but no potash or sulfur deposits have yet been found and the only phosphate rock deposits located are small and low grade.

The mission recommended considering local production of industrial acids even though consumption is still small. It also recommended starting a salt industry. This would be important as industrial demand for salt and its products increases. Already, caustic soda is being used in substantial tonnages for soapmaking.

Despite Nigeria's flourishing publishing industry, there is no paper plant yet. When one is built, chlorine will also be in demand.

Land of Ulcers: Since there's a dearth of available statistical material, spotting profitable investment and marketing opportunities is difficult. But an even bigger problem, U.S. entrepreneurs have discovered, is taking advantage of these opportunities once they are pinpointed.

By all accounts, Nigeria is a land of business frustrations. For the most part, they are the result of the problems facing any young and inexperienced nation, plus a few local variations—e.g., a smothering climate.

Nothing can be done in a hurry in Africa, and Nigeria is no exception. Old hands warn prospective investors that they had better bring along a lot of patience and money or not come at all. The landscape is littered with the wrecked plans of businessmen who breezed in, expecting to get things rolling overnight, only to leave with nothing accomplished and much money spent.

One reason for such failures is the government's involvement in all projects—both the federal and regional governments. Discussions are usually prolonged because key officials are touring abroad or are home mending political fences. More trouble comes from the competition between the three regions for new industries. (The Western and Eastern regions each have their own public relations agencies in New York.) The political implications of each venture are weighed, and sometimes take precedence over the economic.

Reaching a decision on granting pioneer industry certificates to one of two rival projects can take many months. This political element even causes problems within individual governments. Recently, one member of a regional ministry was reported avidly seeking American capital for a project while a man in an adjacent office was hotly pursuing British capital for the same scheme.

"The government has the spirit of cooperation but it is so painfully slow in implementing its policies," complains one manufacturer, who had to wait 18 months for the paper giving him tax relief, and two years for the tariff adjustment necessary to get his business under way.

Sitting out these negotiations can be expensive, with hotel bills, rents and travel costs high.

There have been cases of regional government officials interfering with the hiring of personnel, making sure that only politically friendly men and women were taken on, or pressing to get incompetent relatives hired.

Bribery is frequently expected and offered, according to several business sources. Bribes help win a contract or get a septic tank cleaned faster. And one American in Lagos asserts, "The American businessman is not without sin. He sometimes wants to do things the easy way."

There are other problems too. Land and construction costs are high, electricity is expensive and short, and power failures are frequent. One executive estimates power costs are three times higher than in the U.K. The land problem, at least, is being eased by new industrial estates.

The government encourages foreign companies to "Nigerianize" their staffs. Besides being politically expedient, having Nigerians in responsible positions can help smooth operations, since they can deal with the public with greater ease and acumen than can expatriates. But it is not easy to find Nigerians who can be trained for executive positions. The average university graduate finds government service more appealing than the business world, and those who choose business often feel that their education entitles them to a high position soon. But once he has been well trained, says an oil company official, a Nigerian is usually as competent as the expatriate he replaces.

Economics provide another reason to Nigerianize. Maintaining an American costs twice as much as a European's maintenance, four times as much as a Nigerian's. For one U.S. oil company, West Africa is the only part of the world where hardship allowances are still considered necessary. And Americans need regular home leaves and expensive housing. Lagos rents have doubled in the past two years; an ordinary two-bedroom house rents at $5,800/year and up—payable five years in advance.

Limited school and entertainment facilities and unhappy wives are other compelling reasons for replacing U.S. personnel as soon as possible.

Taking on Nigerian partners is generally advisable. In some cases—e.g., in cosmetics ventures—it is virtually necessary, because the government believes local talent is available and discourages ventures that don't use this talent beyond a limited period for training purposes.

While it's difficult enough to find a suitable Nigerian partner, it's more difficult—and dangerous—to drop him. Nigerians tend to be contentious and may also resort to violence, according to U.S. observers in Lagos. Even going into business with a re-

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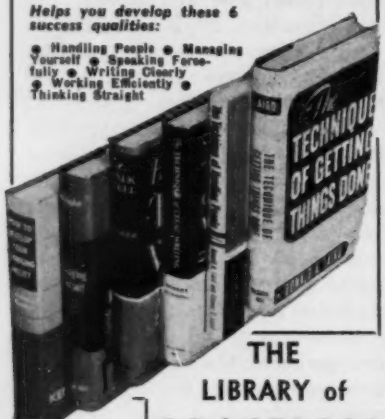

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gional development board can be risky. Two Americans recently ran into trouble because one of the boards failed to put up the capital it promised as its share in their venture. The Americans will probably lose much of their own investment.

One of the greatest stumbling blocks, however, for U.S. businessmen in Nigeria is their lack of knowledge of local conditions. They are often naive, one U.S. expert stationed in Nigeria notes. They expect to be able to apply the same techniques they have applied successfully at home, and they are in a hurry and impatient for results. But impatience can be fatal to their plans because Africans resent it. Too many Americans have talked to Nigerians about grandiose schemes, then have failed to follow through.

One way to work in this unfamiliar territory is to tie in with British firms that have long experience in the market. In fact, it's virtually a prerequisite to success to get the cooperation of the British or other European companies that control the channels of distribution.

The five most important trading companies in Nigeria are United Africa Co. (British), Union Trading Co. (Swiss), A. G. Leventis (Greek), Societe Commercial de L'Ouest Africain, and Compagnie Francaise de L'Afrique Occidentale (both French). They are active in almost every phase of Nigeria's commercial and industrial life. These and other European firms' grip on distribution channels has been a major bar to any substantial increase in U.S. exports to Nigeria. The market is too small to warrant most U.S. exporters' setting up their own distribution organization, so one solution may be to find an African agent. But then a further problem arises: most of the capable agents are already overloaded, can't even do justice to their present lines.

Nevertheless, many firms are surmounting the problems of doing business in Nigeria. "Nigeria is not a country for the lazy man," says one American businessman in Lagos. "I've listened to some Americans' complaints. They're finding the going tougher than they anticipated and they're looking for scapegoats." The fact is that more than 20 U.S. companies are now established in Nigeria and are finding their gains are worth the trouble.

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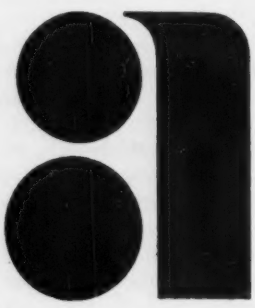
Liquid—23.7°C/4° . . . 1.00
20°C/4° 92
Gas 0°C, 1 atmos . . . 1.74
BOILING POINT °C, 760 mm . . . —23.76
°F, 760 mm . . . —10.76
REFRACTIVE INDEX, n 20°/D
Liquid—23.7°C . . . 1.3712
Gas 25°C . . . 1.000703
SOLUBILITY (in cc.) of Methyl Chloride Gas in 100 cc. of solvent (20°C, 760 mm)
Water . . . 303
Benzene . . . 4723
Carbon Tetrachloride . . . 3756
Glacial Acetic Acid . . . 3679
Ethanol . . . 3740



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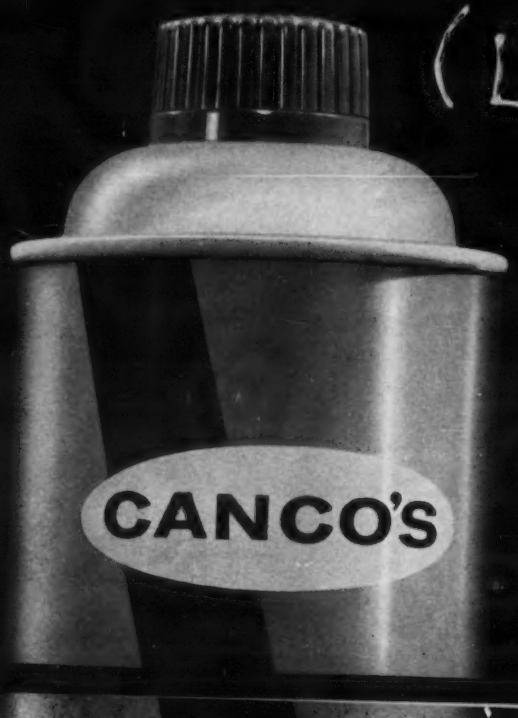

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—FLEXOL Plasticizer 13-13
—NIAX Triol LM-52
—Improved Acrylates

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FLEXOL Plasticizer 13-13 (di-tridecyl phthalate) is a new primary plasticizer for vinyl chloride resins and copolymers. This plasticizer is particularly useful in formulations for vinyl automotive upholstery where low soapy water extraction and anti-fogging properties are critically important.

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Pour Point, °F.	−35
Flash Point, °F.	450
Viscosity, cps. at 25°C.	190
Refractive Index, at 25°C.	1.4835

You can obtain complete information on the interesting properties of both FLEXOL 13-13 and 13-13X through your nearest CARBIDE Technical Representative, or by using the coupon below.

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Lower inhibitor levels offer several distinct advantages during production of latexes. Formulators need less catalyst to overcome the inhibitor, polymerizations start faster, and the possibility of color development from the catalyst-inhibitor reaction is greatly reduced.

The following table summarizes inhibitor levels for acrylic acid and its esters. The new grades are indicated by asterisks (*):

	HQ ppm	MMHQ ppm
Ethyl acrylate	200*	200
Butyl acrylate	60*	60*
2-Ethyl-hexyl acrylate	100	100 60*
Acrylic acid, glacial	—	500
Acrylic acid, aqueous	—	500

Extensive tests indicate that these new, low-inhibitor grades can be shipped and stored in the same way as higher-concentration grades.

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Target: Boost Research's Batting Average

Pressed by the continuing squeeze on profits, chemical process companies are seeking ways to boost the profitability of their research. For many, a significant facet of this effort is concerned with developing and refining methods of assessing the probable payout of new ventures. Object: to select those research project proposals that have the best chance of yielding a solid return on investment.

A well-thought-out approach to this problem will soon be unveiled in a paper now being prepared by Robert Smith, of Sinclair Research (Harvey, Ill.). Sinclair relies on a specific index it calculates for each proposed research project, both basic and applied. The firm bases almost all its research-proposal evaluations on this index.

No Magic Number: The index number is not the absolute decision-maker, however. Smith, who developed the system, says, "The index is for a consistent basis of evaluation, one that provides a quantitative grasp of the relative worth of all the projects under consideration."

What the index does is pin down the factors that should be considered in project evaluation. The index I equals PN/C. P is a combined probability factor; N is the estimated net increase in wealth to the whole Sinclair organization resulting from the successful commercialization of the project; and C is the estimated total future research cost of the project.

Probability is the product of values in three categories. The first accounts for the chance of technical success of the project; the second for its acceptance by Sinclair's manufacturing department and the third for the probability of meeting all the predictions. The first and second factors are derived from checklists that pose questions—e.g., Does Sinclair have the proper marketing channels? Does the company have technical experience with similar projects? Is there existing literature on the subject? And a graph is used relating return on capital invested in the project and its life expectance.

To calculate C, the estimated research cost, the firm uses experimental design techniques (*CW, Dec. 24, '60, p. 63*) that simplify the handling of many independent variables. Using methods similar to those developed by George Box of the University of Wisconsin (*CW, Oct. 24, '59, p. 75*), Smith employs "tent," "star," "box" and other statistical plotting patterns to reduce the number of points necessary for correlations.

In calculating N, the net increase in wealth made by a successful research project, all future estimated income is discounted back to the present. The cut-off point for the life of a new product with long-term expectations is taken at 10-15 years.

Sinclair's Robert Smith: In statistics, a way to weed out the least promising.

Case History: The development of a refining catalyst and process provides a good example of how the Sinclair system works. To arrive at the index, these estimates were made: royalties saved because the firm would have to license a process if it did not develop its own—$2.25 million; increased product yield over the best available process—$4 million; and decreased catalyst cost—$1.6 million. (All these figures are on a five-year basis, which was taken for study purposes. In practice, the full life of the process, pegged at 15-20 years, would be used.)

The sum of these three figures, $7.85 million, is the total estimated increase in wealth to Sinclair, N in the formula. The over-all probability of success was taken as 0.8. And the estimated future research cost, C, was $520,000. Thus the index, PN/C, equals 12, which is relatively high; most indexes are above five.

The catalyst was developed and introduced into commercial processing in '54. Through '59, savings were: royalties—$3.75 million; increased product yield—$2.04 million; and decreased catalyst cost—$1.91 million. So the actual N turned out to be $7.70 million. However, the research cost proved to be $1,623,000, three times the estimate. Smith points out that this is not a defect in the system, as all the research cost estimates were made in the same way (all were understated by the same factor) and the relative value of projects remains the same.

Putting It in Perspective: Arriving at the best possible index numbers could be a full-time job for a project evaluation department, since Sinclair makes about 40 evaluations and re-evaluations every year. Consequently, each researcher makes his own calculations—with the help of the company's economics and other specialized departments. An index calculation can take from a few hours to a few weeks, depending upon how much data has been previously collected and how large the project is.

Each proposed project gets a single index number. And one index is rated against another. However, all the indexes are carefully dissected by the research company's advisory council: a group of research associates, the director and his two assistants. The council tries to keep all the index calculations uniform, reduce subjectivity.

Sinclair's experience has shown that the council deemphasizes 40% of the proposed projects, strongly emphasizes 15%.

Not Alone: Sinclair's faith in a formula is not unique. Alcolac Chemical Corp. (Baltimore, Md.) has calculated project indexes for the last five years. The Alcolac index includes an estimate of ultimate capital investment as well as anticipated research costs.

Olin Mathieson has also used an index (*CW, May 30, '59, p. 35*). But W. E. Hanford, vice-president for re-

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search, feels that a project index "just can't do the job—there are too many subjective factors in a proposal evaluation."

This feeling is echoed throughout much of industry. Most firms apply several yardsticks to a proposal, without attempting to combine them into a single number. At American Cyanamid's Stamford, Conn., Central Research Division, for example, applied-research proposals are chosen on the basis of these estimates: return on investment, payout time and sales turnover.

And at W. R. Grace's Washington Research Center (Clarksville, Md.), all new projects are appraised in five categories: financial, marketing, production, research and development and patent status.

Forced to Quantify: Alcolac Chemical's formula is the ratio of estimated annual profits to total capital costs and research expenses. Carl Pacifico, the general manager of this surfactant manufacturing firm, says, "The formula forces department managers to quantify their proposals." One check reportedly showed that 80% of estimated profits materialized.

Alcolac's project number consists of five factors in the numerator: (1) likelihood of commercial success; (2) likelihood of technical success; (3) expected production output in lbs./-year; (4) expected price minus unit cost; (5) expected life of the product, in years. These factors are multiplied, and their product is divided by the total cost necessary to get the project into commercial operation. This includes costs of research, engineering, market development, physical plant, plus working capital and miscellaneous costs—e.g., patent royalties.

The company, which did about $3-million business last year, has combined the factors of venture analysis and research-proposal analysis. This differs from the Sinclair formula in which most attention is focused on required research cost, not the total investment needed to commercialize a potential product or process.

Another Index: The Olin Mathieson index, devised by former vice-president of research, Fred Olsen, was similar to the Sinclair index, except that the period of profits for the venture in question was taken to be much shorter. For a process improvement, the value of research was taken as the

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full savings for one year. For a product improvement, the value was 2% of product sales for two years. If the index was less than three, Olsen advised that the research project should be abandoned.

This index is obviously easier to calculate than Sinclair's. But Olin's current management feels that it goes too far in attempting to pin down intangibles. Today, Olin uses different forms of analysis for different kinds of projects.

Different Objectives: There's good reason for different firms to handle new research-project proposals in different ways. The smaller companies can afford relatively little basic work.

Alcolac's combination formula is suited to its development-oriented management. At the other extreme, General Electric Co.'s central research laboratory in Schenectady, N.Y., justifies its projects simply if they are within the general business interests of GE, and scientific in nature.

W. R. Grace's Dewey and Almy Division once used a checklist system for evaluating new projects. But this was solely because it had a temporary need for a system to sift through many new project proposals.

Whether it selects new projects by formula or checklist, cost-conscious research management is showing more determination than ever to inject science into the chancy business of picking a winner.

EXPANSION

- Fairchild Semiconductor has broken ground for a 65,000-sq.ft., $1.5-million research and development center at Stanford Industrial Park (Menlo Park, Calif.).
- Owens-Corning Fiberglas Corp. has dedicated a multimillion-dollar technical center at Granville, O.
- Dow Chemical Co. has started construction of a new chemical physics laboratory at its Midland, Mich., research center. In addition to carrying on the firm's work in spectroscopy, the new building will house new projects in solid-state physics, inorganic chemistry, photochemistry, and research on molecular beams and product ideas based on radiation chemistry.
- Pratt & Whitney Aircraft has set up a new Advanced Materials Research & Development Laboratory

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is our "cup of tea"

Tecquinol is Eastman's technical hydroquinone. Over the years, no supplier has devoted more attention to its manufacture and use. Our interest was both early and logical, for hydroquinone is required in all black and white photographic developing and is used in many color processes as well.

Today, hydroquinone is important also because of its role as an industrial inhibitor and chemical intermediate.

Tecquinol, because of its reduction potential, is widely used to control polymerization reactions, particularly those catalyzed by peroxides. For example, it is being used in acrylates, methacrylates, vinyl acetate, and other vinyl monomers. Tecquinol is effective both in inhibiting the monomer during transit or storage, and in stopping the polymerization reaction when the desired conditions have been reached. Because of its antioxidant properties, it also finds use as an inhibitor for industrial fats or oils and as an antiskinning agent for paints and varnishes.

Tecquinol is valued as an intermediate, too. It is an economical starting point for many organic syntheses, a number of which are indicated below.

- **aliphatic amines** → **N-alkyl p-aminophenols and dialkyl p-phenylenediamines**
- **phthalic anhydride** → **quinizarin**
- **carboxylic anhydrides or acid chlorides** → **hydroquinone esters**
- **alkylating agents** (alkaline conditions) → **hydroquinone mono- or di-ethers**
- **olefins** (catalyst) → **mono or dialkylated hydroquinones**
- **sulfuric acid** → **hydroquinone-mono- or di-sulfonic acid**
- **halogens** → **halogenated hydroquinones**
- **hydrogen** → **quinitol**
- **sodium chlorate** → **benzoquinone**
- **benzoquinone** → **quinhydrone**
- **ethyl acetoacetate** → **4-methyl-6-hydroxy-coumarin**
- **Mannich condensations** → **2,5-bis-dimethylaminomethyl hydroquinone or 2,5-dimethyl hydroquinone**
- **Kolbe carboxylation** → **gentisic acid**

We will be glad to share our knowledge of hydroquinone and its derivatives with you. A bulletin (D-104) has recently been prepared for those who are interested in investigating this versatile chemical. For your copy, write Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, Kingsport, Tennessee.

Eastman
CHEMICAL PRODUCTS, INC.
Subsidiary of
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Kingsport, Tennessee

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tenn.; Atlanta; Boston; Buffalo; Chicago; Cincinnati; Cleveland; Detroit; Greensboro, N. C.; Houston; Kansas City, Mo.; New York City; Philadlphia; St. Louis. **Western Sales Representative: Wilson & Geo. Meyer & Company,** San Francisco; Los Angeles; Salt Lake City; Seattle.

Chemical Week

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at its Hartford, Conn., plant. About 30 senior scientists will set up the laboratory, devote their attention to development of high-strength materials, alloys for use at extreme temperatures, and materials for energy conversion devices.

• McNeil Laboratories, Inc., has dedicated its new headquarters at Fort Washington, Pa. One of the three new buildings is devoted to chemical, biological and pharmaceutical research.

• Procter & Gamble Co. is planning a 50% expansion of its Winton Hill Technical Center in Cincinnati. Two new buildings with 150,000 sq.ft of floor space will be completed in early '63.

• Anaconda American Brass Co. has dedicated a new $1.5-million research center at Waterbury, Conn. The present staff of 100 is expected to be expanded in the near future.

• Union Carbide Nuclear Co. is now operating its nuclear research reactor at Sterling Forest, N. Y. The 5,000-thermal-kw. unit was built by American Machine & Foundry Co.

• Simpson Timber Co. has dedicated a new research center at Overlake Industrial Park (Bellevue, Wash.). The 22,000-sq.ft. building will house nine forest product research and development labs and a pilot plant.

• Arthur D. Little, Inc. (Cambridge, Mass), has opened a Mexican subsidiary, Arthur D. Little de Mexico, S.A. It will be under the direction of Richard L. Bolin.

• Southern Research Institute (Birmingham, Ala.) has added new units for wet-, dry- and melt-spinning of synthetic fibers for mono- or multifilament yarns. These will permit evaluation of fiber-forming characteristics of new polymers or modifications of existing polymers.

• A new, $500,000 polycarbonate engineering lab is going into operation at General Electric Co.'s Mount Vernon, Ind., polycarbonate plant.

• Hewlett-Packard Co. (Palo Alto, Calif.) has formed a new affiliate, HP Associates, for solid-state research and development.

• The Midwest Research Institute (Kansas City, Mo.) has organized a center for study of germanium technology. It will be called Germanium Information Center; its formation is being sponsored by several U.S. and foreign firms.

Tracers

TO THE CHEMICAL PROCESS INDUSTRIES

POSITIONS VACANT

Technical Director: An important position for outstanding man with chemical background and well-rounded knowledge of insecticides, fumigants and material used in pest control work to head service department of a large pest control company located in large eastern city. Important position for a man with experience, sales ability and capable of handling service men and customers and possessing managerial ability. This is an unusual opportunity for the right man. Remuneration to meet expectations plus many fringe benefits. Must be available immediately. All replies strictly confidential. Submit account of academic and professional training, past employment, earnings, photo and other pertinent facts to P-7520, Chemical Week.

Stanford Research Institute has an interesting opportunity for a Chemical Economist to conduct economic analyses of various segments of the chemical industry as part of an industry-supported service. This opening provides opportunity for personal and professional growth to graduates in Chemistry or Chemical Engineering who have at least a year's experience in market research or a related activity. Your resume will be welcomed by W. C. Pedersen, Stanford Research Institute, Menlo Park, California (an equal opportunity employer).

Chemical Advertising Copywriter: New York City 4-A agency needs an advertising copywriter with a chemical degree as a member of an account group serving one of America's blue chip chemical companies. Chemical education is a requirement; copywriting experience alone on chemical accounts is insufficient. You will work with others heavy in chemical experience with all advantages of responsible, rewarding position. Write in confidence giving full details of education and experience. Salary open to right man. Our staff knows of this advertisement. P-7644, Chemical Week.

SELLING OPPORTUNITIES AVAILABLE

Technical Sales-B.S. or M.S. Chemists & Chemical Engineers to sell our PVAc resins and emulsions, known for their uses in surface coating, paints, sizings, papers and/or textiles, and in automobile safety glass inter-layers. Pre-assignment training at Springfield helps assure success. You are assured of competitive salaries, liberal benefits, relocated expenses, educational aid programs and pleasant working environment in recreational New England. Investigate these openings by sending your resume, in complete confidence, to: Mr. George F. Henderson, Manager Technical Recruitment, Shawinigan Resins Corporation, Springfield 2, Mass.

Industrial Chemical Salesman-Aggressive Chemical Mfr. offers excellent growth opportunity for representative with minimum 3 yrs. field experience. Chemical or Chemical Enginering degree or equivalent necessary. Under 35 yrs. old and free to travel and relocate. Salary commensurate with expeience. Travel expenses, company automobile, and benefit program. Send resume to: Carlisle Chemical Works, Inc., Reading Ohio.

Pharmaceutical Chemical Sales: Long-established, New York City based, chemical sales company has opening for a young man for inside and outside sales work on pharmaceutical bulk chemicals. Excellent opportunity for man with initiative and imagination. Must have chemical degree or equivalent and have completed military service. Straight salary commensurate capability, experience and subsequent performance. Give resume with full background, training, salary. RW-7615, Chemical Week.

SELLING OPPORTUNITIES WANTED

Sales Engineering Organization specializing in the sale of mechanical equipment to the Petrochemical industries along the Texas and Louisiana Gulf Coast, desires one or two additional accounts. Reply to RA-7569, Chemical Week.

Wanted—Manufacturer's Rep., located in Cincinnati; desires line for chemical, paint, food, and beverage industry. Reply RA-7607, Chemical Week.

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Are you overlooking an Important Outlet for your products? Well-established International Sales Organization offers to you its World-Wide facilities to obtain a share of the ever-expanding export market for your products by acting as your export department. Your inquiries invited. Please write, with full details about your products, to RA-7638, Chemical Week.

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BUSINESS OPPORTUNITIES

Wanted To Buy—Any business that makes chemicals, chemical specialties or allied products. Will go to $500,000. BO-7598, Chemical Week.

European Chemical Co. has need for a consultant in: Leather Chemicals. We demand process improvement, new processes, application know-how, etc . . . Contact: Havas No. 217/598, Rue Vivienne 17-Paris (France)

BOOKS

For recovery of precious metals catalysts, solutions send for recovery schedule. Precious Metals Recovery Corp., 85 River Road, Nutley 10, New Jersey.

EQUIPMENT FOR SALE

Disintegrator, Reitz - RDH-18. Heavy duty with 50 HP motor and starter. Rosenthal, 1841 N. 2nd St., Phila. 22, Pa. REgent 9-2816.

Shredder/Mixers, Baker-Perkins. Double sigma blades, screw tilt, 320 gal. cap., jacketed. Rosenthal, 1841 N. 2nd St., Phila. 22, Pa. RE 9-2816.

Filter Presses, Shriver, closed delivery, pyramid design. 30",24",12". Any amount plates, frames. Rosenthal, 1841 N. 2nd St., Phila. 22, Pa. RE 9-2816.

Evaporators, Swenson. Rubber lined, karbate tubes, 250 ton/day capacity. Rosenthal, 1841 N. 2nd St., Phila. 22, Pa. REgent 9-2816

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Multi-million dollar chemical plant at North Little Rock, Ark. Stainless Steel & glass-lined equip. Send for detailed circular. Perry, 1415 N. 6th St., Phila. 22, Pa.

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Niagara #36H-350-2, 7316 Stainless filter, 330 sq. ft., Vert. leaf, horiz. jacketed tank. Perry, 1415 N. 6th St., Phila. 22, Pa.

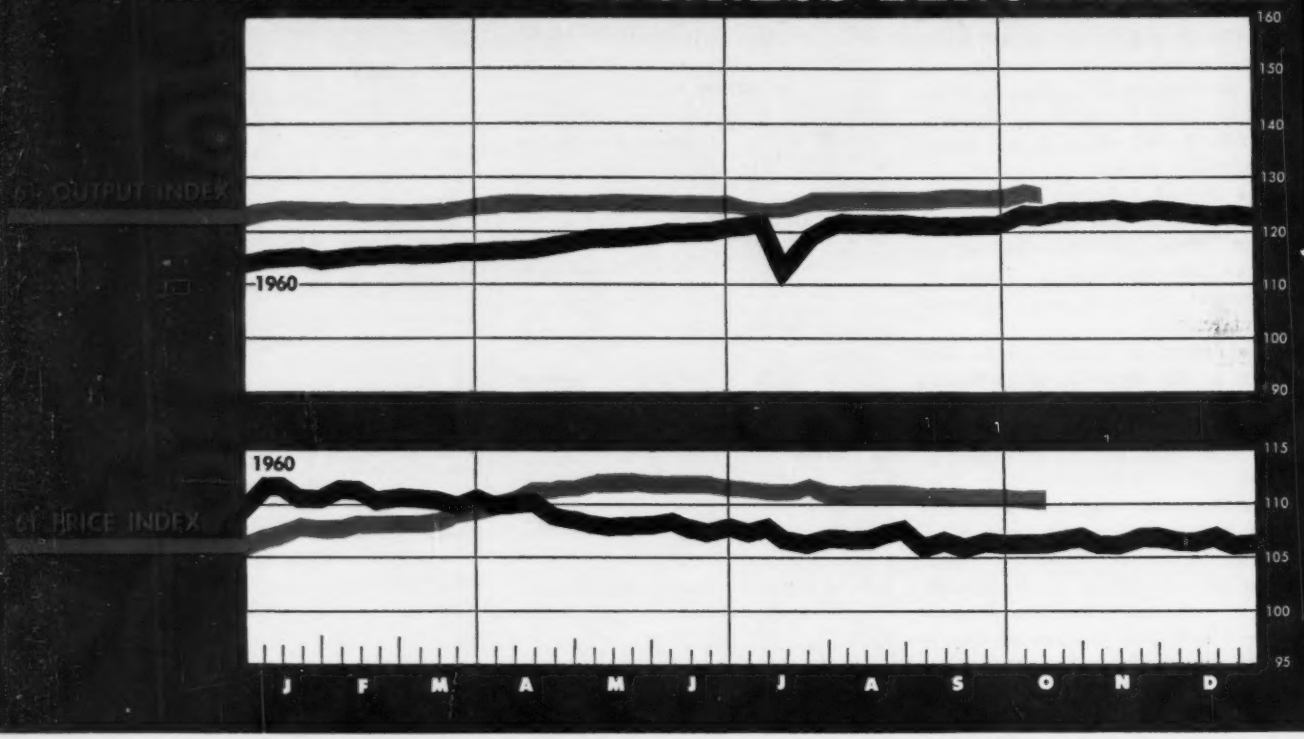
CHEMICALS FOR SALE

Chemical Grade Iron Powder—20 Mesh. Large tonnage available Contact: Robert Craig, Micro Metals Corp., 99 President St., Passaic, N. J., PResCott 8-6689.

CHEMICALS WANTED

Surplus Wanted—Chemicals, Pharmaceuticals Oils, Acids, Plasticizers, Resins, Dyes Solvents, Pigments, Etc. Chemical Service Corporation, 96-02 Beaver Street, New York 5, N.Y. HAnover 2-6970.

BUSINESS BENCHMARKS



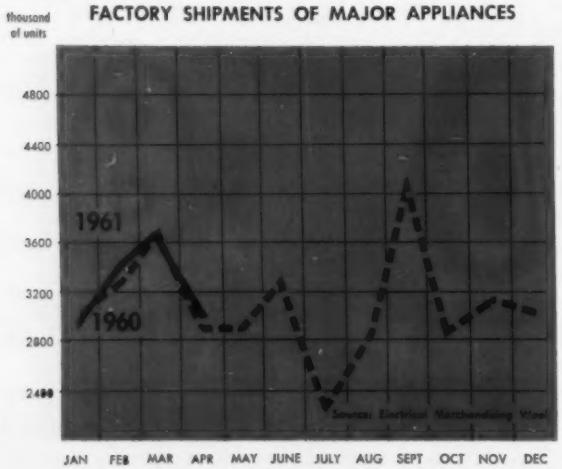
OCTOBER 14, 1961

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Chemical Week output index (1957=100)	125.9	126.1	124.3
Chemical Week wholesale price index (1947=100)	110.1	110.0	106.5
Stock price index (12 firms, Standard & Poor's)	53.59	53.78	44.82
Steel ingot output (thousand tons)	2,131	2,114	1,558
Electric power (million kilowatt-hours)	15,340	15,025	14,161
Crude oil and condensate (daily av., thousand bbls.)	7,156	7,145	6,849

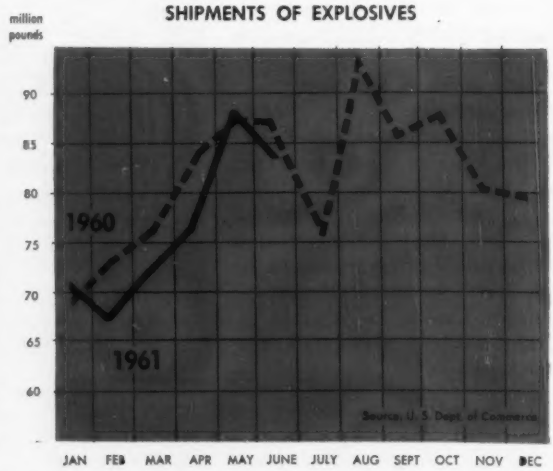
EMPLOYMENT INDICATORS (thousands)	Latest Month	Preceding Month	Year Ago
All manufacturing	15,948	15,975	16,250
Nondurable goods	6,824	6,806	6,908
Chemicals and allied products	887.5	884.4	878.9
Paper and allied products	551.2	556.4	560.5
Rubber products	245.9	247.2	252.5
Petroleum and coal products	216.2	220.7	230.2

CHEMICAL CUSTOMERS CLOSE-UP

FACTORY SHIPMENTS OF MAJOR APPLIANCES



SHIPMENTS OF EXPLOSIVES



Try this 5-second test for yourself:
1) start with caky powder (it's red lead here).
2) add just 1.0% Cab-O-Sil by weight.
3) shake vigorously for 5 seconds and observe results.

solves caking problems

Increase the sales appeal of powdered products with Cab-O-Sil. Free-flow characteristic is retained, even after long periods of shelf storage. These qualities in your product can give you a decided competitive advantage. You can also increase profits by cutting production costs through more accurate weighing, faster handling, and a less expensive package.

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- **Suspending agent** — paints
- **Flatting agent** — varnishes, lacquers, organosols, plastisols
- **Reinforcing agent** — rubber, silicone, latex film
- **Anticaking agent** — sulfur, insecticides
- **Antislip agent**—solvent-base floor waxes
- **Precoating material** — reproduction paper
- **Low temperature thermal insulation**
- **Pharmaceuticals and cosmetics — (See bulletin #cpha-1)**

Please send ☐ free Cab-o-sil sample and other technical data checked

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Technical data available:

( ) General Properties, Functions and Uses (#cgen-1)
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( ) Cab-O-Sil in Dipped Latex Films (#crub-3)
( ) Cab-O-Sil in the Lubricating Grease Industry (#cgre-2)
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( ) Cab-O-Sil in the Plastics Industry (#cpla-2)
( ) Cab-O-Sil in Automobile Polishes (#cpol-1)
( ) Cab-O-Sil in Pharmaceuticals and Cosmetics (#cpha-1)

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